# Engineering multifunctional nanocarriers for therapy and bioimaging

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## Abstract

One of the most important tasks of surface and polymer chemistry or nanomedicine is the development of multifunctional colloidal drug delivery systems (DDS), i.e., theranostic nanoparticles, multiple drug nanovehicles, smart DDS, that can transport simultaneously many unique components, including therapeutic (cytostatics, photosensitizers, drugs of a natural origin such as e.g. flavonoids) and diagnostic (organic dyes, semiconductor nanocrystals, up-converting nanocrystals) agents within a single nanocarrier (for the general idea see Fig.1). In particular, such nanocarriers may be designed to transport hydrophobic cargo to the site of disease. Co-encapsulation of selective and active compounds into a variety of polymeric nanocarriers can be performed using different strategies, including the following: self-aggregation, interfacial deposition – co-solvent removal, interfacial polymerization or/and core-shell entrapment, physical adsorption and chemical immobilization or conjugation. Such approaches may in principle permit targeted cancer therapy, combination cancer therapy, molecular diagnosis, and − in case of nanotheranostics − simultaneous monitoring and treatment. One of the key functions of a variety of nanocarrier-based delivery systems (the threshold nanoparticle sizes <200 nm for extravasation into tumors) is to serve as shields to protect the drug molecules from premature degradation and unexpected harmful side-effects from degradation and various toxic interactions with the biological environment. Other crucial features of such nano-co-encapsulated systems are in the fields of efficacious drug loading capacity, chemical and physical stability, sustained and successful delivery to the target cells, as well as selective accumulation in the malignant tissues without damaging the healthy cells.

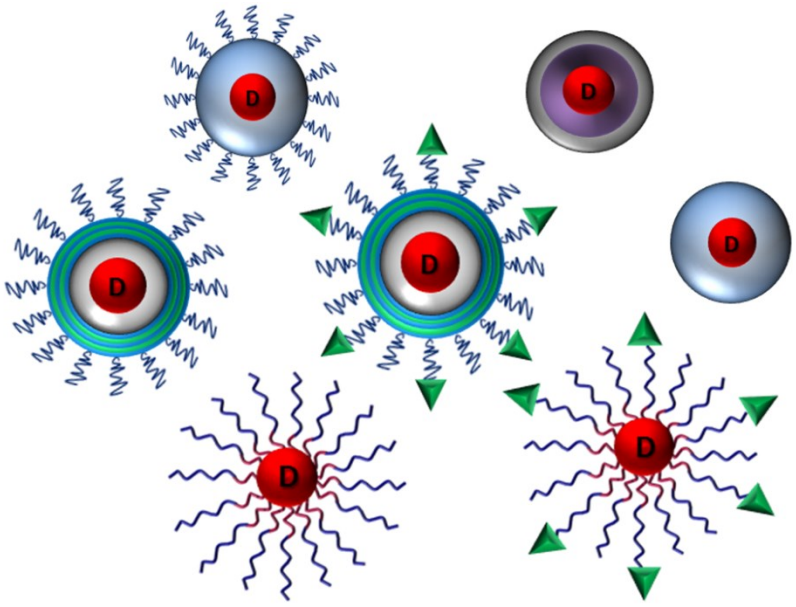


Figure 1. The schematic presentation of the custom-designed multifunctional nanocarriers.