Drug Delivery Nanosystems for Modern Targeted Therapy

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Each active pharmaceutical ingredient (API) is formulated into a dosage form for administration for the purpose of treatment or diagnosis, which corresponds to the desired method of application/route of administration and whose main function is to enable or facilitate the production/preparation, storage and administration of drugs, and whose properties also favourably influence the behaviour of the API (drug) in organism. Dosage forms can be differentiated into multiple generations, with the use of next-generation drug delivery systems (with controlled release and targeted distribution) improving the efficacy of many existing APIs and enabling the introduction of new therapeutic approaches. The effort to miniaturize them from macro-dimensions (>1 mm) to micro-, submicro- to nano-dimensions can be traced back to the 1990s, with great progress in recent years with the massive onset of nanotechnology. Various nanoemulsions of lipidoid formations or colloidal nanodispersions are very popular, i.e. nanoliposomes, solid lipid nanoparticles and other nanovesicles, dendrimers, polymer systems, tubules and quantum dots are used as drug carriers. Currently, drug delivery nanosystems made of non-toxic biodegradable biomaterials are preferred, however, in the case of nanoformulations for cancer therapy or diagnosis, inorganic nanocarriers made of metals/metal oxides, metalloids or carbon are also used, which often potentiate the effect of the API itself. Nanosystems for drug delivery enable targeted distribution to be easily achieved, whether it is a passive distribution, based on the size of the nanosystem or the EPR effect, or active, i.e. based on the modification of the surface of the nanoparticles, or in the case of a so-called magnetic nanoparticle, the application of an external magnetic field. The contribution is focused on a brief introduction to systems enabling the innovative administration of drugs already in clinical use, especially in the therapy of infectious and inflammatory diseases and cancer.

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