Self-Assembling Nanoparticles Composed of Transmembrane Peptides and Their Application for Specific Intra-Tumor Delivery of Anti-Cancer Drugs

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Technology description

Summary

The current invention discloses peptide based nanoparticles as an alternative to liposomes. The nanoparticles have a diameter of 8-10 nm and are much smaller than a liposome thus providing better tumor penetration. Peptides corresponding to transmembrane domains of a number of integral membrane proteins have been discovered that spontaneously self-assemble in aqueous solutions into stable and remarkably uniform nanoparticles. The nanoparticles of the current invention are fully synthetic, and their surfaces can be functionalized with ligands that provide specific binding to cell surface receptors overexpressed on tumor cells. Thus, they are even more specific for tumor targeting. Nanoparticles constructed from transmembrane domains of certain receptors and transporters have biological activity of their own and inhibit metastasis or drug resistance thus sensitizing tumors to therapy. Hydrophobic drugs can be easily entrapped inside the nanoparticles, which not only solve the problem of drug insolubility under physiological conditions, but also generate a form of a drug that concentrates in tumors due to enhanced permeability and retention (EPR) effects.
Market:
Drug delivery remains one of the biggest challenges for the pharmaceutical industry. Nearly all therapeutics currently on the market are delivered in a non-specific manner to the whole body, and this results in unintentional side effects. The Food and Drug Administration (FDA) has created a new class of therapeutic products using nanoparticulate drug delivery system. In 2005, the first nanoparticulate drug delivery product, Abraxane, for the treatment of breast cancer, was launched. The worldwide R&D investment in nanotechnology research and development in 2004 from both public and private sectors was an estimated $US8.4 billion, 15% of which will be focused on nanobiotechnology.

Application area

Self-assembling nano-particles as an alternative to liposomes, inorganic, dendrimeric or polymeric nanoparticles.

Nanoparticles have biological activity of their own and can inhibit metastasis (CXCR4 receptor antagonists) or drug resistance (inhibitors of ABCG2 transporter and p-glycoprotein) thus sensitizing tumors to therapy.

Advantages

The nanoparticles are superior in stability, uniformity, ease and reproducibility of preparation compared to conventional liposomes, are much more uniform and less toxic than inorganic, polymeric or dendrimeric nanoparticles.
The nanoparticles are much smaller than a liposome thus providing better tumor penetration.
Synthetic nanoparticles can be easily coated with receptor ligands and loaded with hydrophobic drugs for more specific tumor targeting.

Institution

NIH - National Institutes of Health

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