Polypeptide-Peptide Nanoparticles (PoP-NPs) for Intracellular Delivery

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Technology

Prof. Rapaport developed self-assmbled nanoparticles (NPs) system composed of naturally produced anionic polypeptide poly-γ-glutamic acid (γ-PGA) and a designed amphiphilic and cationic β-sheet peptide (PFK), which tends to form fibril bilayer assemblies. These peptide assemblies generate hydrophobic niches within the NPs, which enhance the capacity of the NPs to deliver amphiphilic substances.

PoP-NPs can be formulated to carry different types of drugs, from small molecules to proteins and oligonucleotides. Moreover, it enables the delivery of hardly soluble drug molecules, with reduced side effects and immunogenicity. NPs also possess the outstanding advantages of passing through the capillary blood vessels, tissue gaps, and penetrating cells by endocytosis. Specific peptides can easily facilitate trafficking NPs to specific cells and intracellular organelles.

Prof. Rapaport already demonstrated *in vivo* that NPs could be utilized as targeted drug delivery systems for cancer therapy. The NPs provided a vehicle for the known anticancer drug lonidamine (LND). This drug was suspended from use at the clinical trial stage because of its hepatotoxicity due to poor solubility and pharmacokinetics. Using the NPs, the drug reached effective (300 more cytotoxic) and therapeutically relevant concentrations without toxicity.

Application

Drug delivery, especially non-soluble drugs, to specific cell organelles.

Advantages

- Prepared by self-assembly (no chemical reaction) – simply by mixing components at room temperature
- Simple to prepare
- Fit to hydrophobic drugs
- Tunable size and charge
- Amenable to coating by targeting peptide sequences
- Non-toxic and biodegradable
- Can be supplied in dry form (lyophilized) – long term stability (2 years)
- Formulation can be adjusted easily to different drug cargos
- No use of organic solvent
- Extended half-life of the drug
- Continuous drug release over time

Patent

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