

## Amphiphilic Core-Shell Nanoparticles for Biomedical Applications

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Gene therapy is a promising treatment for a variety of genetic disorders. The success of gene therapy greatly depends on suitable gene carriers that should provide safe, efficient and targeted delivery. Polyethyleneimine (PEI) is considered to be an effective non-viral gene carrier because of its high complexing ability and excellent transfection efficiency. However, the use of PEI for gene delivery has only achieved limited success owing to its cytotoxicity and broad size distribution of its resultant polyplexes. In the past decade, we have developed a novel class of PEI-based core-shell nanoparticles to tackle these problems. Our PEI-based core-shell nanoparticles possess the following advantages:

- Highly uniform nanoparticles
- Amphiphilic nanoparticles with dense PEI shells
- Tunable particle size range for intracellular uptake (Particles sizes between 50 and 200 nm in diameter)
- Positive surface charges for high loading capacity
- Formation of homogeneous composition
- Reducing PEI cytotoxicity

This type of amphiphilic core-shell nanocarriers have the following features: (1) They are able to complex and protect nucleic acids of different molecular weights; (2) They are three- to four-times less toxic than the native 25 kDa PEI polymer; (3) They have higher gene delivery efficiency owing to their higher cellular uptake ability; (4) For some cell lines, they are much more effective than those liposome-based vectors.

Our results have demonstrated that the core-shell nanoparticle containing a dense PEI layer and a biocompatible core is a unique nano-structural design for safe and efficient gene delivery. This novel type of nanocarriers will find important applications in the delivery of diverse biomolecules into cells.

