Polyplex nanoparticle

Intracellular delivery of nucleic acids to mammalian cells using polyplex nanoparticles remains a challenge both in vitro and in vivo, with transfections often suffering from variable efficacy. To improve reproducibility and efficacy of transfections in vitro using a next-generation polyplex transfection material poly(beta-amino ester)s (PBAEs), the influence of multiple variables in the preparation of these nanoparticles on their transfection efficacy was explored. The results indicate that the even though PBAE/pDNA polyplex nanoparticles are formed by self-assembly of polyelectrolytes, their transfection is not affected by the manner in which the components are mixed, facilitating self-assembly in a single step, but a timing for self-assembly of 5-20 min is optimal. In addition, even though the biomaterials are biodegradable in water, their efficacy is not affected by up to 8 freeze-thaw cycles of the polymer. It was found that there is greater stability of nucleic acid-complexed polymer as a polyplex nanoparticle compared to free polymer. Finally, by exploring multiple buffer systems, it was identified that utilization of divalent cation magnesium or calcium acetate buffers at pH 5.0 are optimal for transfection using these polymeric materials, boosting transfection several fold compared to monovalent cations. Together, these results can improve the reproducibility and efficacy of PBAE and similar polyplex nanoparticle transfections and improve the robustness of using these biomaterials for bioengineering and biotechnology applications [1].

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Wilson DR, Suprenant MP, Michel JH, Wang EB, Tzeng SY, Green JJ. The Role of Assembly Parameters on Polyplex Poly(Beta-Amino Ester) Nanoparticle Transfections. Biotechnol Bioeng. 2019 Jan 13. doi: 10.1002/bit.26921. [Epub ahead of print] PubMed PMID: 30636286.