Abstract

The unique properties of RNA, predictable folding, and formation of stable structural motifs predispose it as a suitable material for RNA nanobiotechnology. Among various reported nanoparticles of diverse biological functions, the majority serve as scaffolds for functional elements delivery. Here we applied the RNA fragment, derived from the CASP8 mRNA, as a substrate for structure-specific endonuclease Dicer processing. Its secondary and tertiary structures prediction led to the novel three-way junction motif identification, 3wj-nRA, and its implementation for the rational nanoparticle design.

The triangular nanoparticle was built on newly characterized 3wj-nRA motif and functionalized with regulatory RNA fragments. RNA monomers and closed trimeric nanoparticles were designed *in silico*, RNA molecules were synthesized and used to deliver regulatory fragments to trigger cellular response. As a reporter, we used the Green Fluorescent Protein (GFP) gene, expressed in model two mammalian cell lines: HeLa and MDA-MB-231/GFP-RFP. Cellular tests showed no toxicity upon delivery of RNA structures in tested conditions but trigger expected fluorescence gene silencing. The effect was stronger for multimeric particles, nanotriangles, comparing to monomers when applied at the same effective concentrations. Initially, the GFP expression in HeLa cells was induced using protein-coding plasmid. In these conditions, RNA nanoparticles silenced the GFP expression after nano-objects transfection in HeLa and MDA-MB-231/GFP-RFP systems.