Multifunctional DNA Origami Nanostructures

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DNA origami [1] is a powerful technique to rapidly fold [2] custom nanostructures that may further serve as sub-nanometer-precise templates for engineering inorganic materials [3] and as building blocks for bridging molecular and macroscopic scales [4]. In biomedical settings, DNA origami nanostructures (DONs) can serve as stimuli-responsive dynamic devices / delivery vehicles [5-7], sensor components [8,9], and diagnostic platforms [10]. However, under physiological conditions the DONs may suffer from poor stability due to low-cation-induced denaturation and enzymatic degradation [11–13]. Interestingly, the stability features can be tuned by internal design [14], and in general, the DON stability is shown to be superstructure-dependent [11–15].

The stability of DONs can be improved by intercalators and versatile, protective molecular coatings. We have combined DONs with chemotherapeutic doxorubicin [15–17], phthalocyanines [18], and lipids [19,20], as well as with “camouflaging” albumins and antigen-targeting antibody fragments [21] to modulate the stability and to enhance the functionality of DONs. Recently, we have coated DONs and hybrid mRNA-DNA origami structures with virus capsid proteins for directing capsid polymorphism, improving the stability and delivery of nucleic acids, and assembling nanoreactors through compartmentalization of enzymes [22–24].

Literature:

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