УДК 577.29

# DESIGN AND DEVELOPMENT OF MARKER-ACTIVATED NANOMACHINES USING DNA ORIGAMI FOR CANCER THERAPY

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**Введение.** Nucleic acid-based gene interference strategies offer promising avenues for therapeutic intervention in human diseases. DNA origami, a revolutionary technique pioneered by Paul W. K. Rothemund in 2006 [1], enables precise folding of DNA into desired structures, opening new horizons for biomedical applications and prompting exploration into innovative approaches for designing marker-activated nanomachines for targeted gene therapy.

**Основная часть.** Nucleic acid-based methods for gene interference, encompassing antisense oligonucleotides (ASO), RNA interference, ribozymes, and DNAzymes, are recognized as powerful tools for both research and therapeutic purposes in treating human diseases [2]. Each of these strategies presents distinct advantages and drawbacks concerning their effectiveness, precision in targeting specific sequences, potential toxicity, and efficiency of delivery. DNA origami is a technique of folding a long strand of DNA (scaffold) into specific shapes using short oligonucleotides (staples) that can bind to this scaffold to achieve the desired shape [3]. The utilization of DNA origami in constructing marker-activated nanomachines represents a paradigm shift in targeted cancer therapy. These nanomachines hold the potential for preserving and protecting nucleic acid agents before their precise release exclusively in cancer cells.
Through careful design, modification, and evaluation of stable DNA origami structures, this research aims to create a highly selective and effective approach for tumor therapy. The project's methodology involves the utilization of advanced software tools for design and optimization, such as caDNAno, alongside experimental validation through in vitro assays. A new DNA nanomachine was designed in the form of a DNA nano-barrel with shorter dsDNA helices protected inside a structure of longer dsDNA helices surrounding the shorter helices, allowing only small-sized nucleic acids to enter through a pore. The additional nucleic acid agents were added as extensions of generated staples in the short helices to be protected from intracellular nucleases. By selectively recognizing and responding to specific cancer markers which can enter through the structure’s pore, the nanomachine enables controlled release of therapeutic payloads, facilitating gene silencing and thus offering a potent means to combat cancer progression.

**Выводы.** By leveraging the versatility of DNA origami structures, coupled with the specificity of nucleic acid-based therapeutic agents, this research holds immense promise for advancing targeted cancer therapy.

**Список использованных источников**:

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