The principle of making DNA nano structure as a drug carrier and the effect

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Introduction

DNA Origami is one of the most recent techniques of utilizing DNA as building blocks for synthesis of nanoparticles. "Origa-mi" is a Japanese word that means folding of plain sheet into an arbitrary form having a specific dimension. Long strands of DNA are folded into a complex scaffold of staple strands having 200 - 300 nucleotides. This leads to formation of a complex structure that has characteristic features because of their na-noscale dimensions (T ϕ rring et al., 2011).

Theoretically, DNA origami has the immense potential to con-tribute significantly in a wide range of fields, such as diagnosis and drug delivery (Zhan et al., 2014). Cancer therapy and diag-nosis is one such potential domain where DNA origami showed significant anticancer efficacy and may contribute immensely. Zhang et al. (2014) demonstrated that doxorubicin-loaded, tri-angle-shaped DNA origami could be an efficient and safe inno-vative platform for treating breast cancer in nude mice (Fig 1).[1]

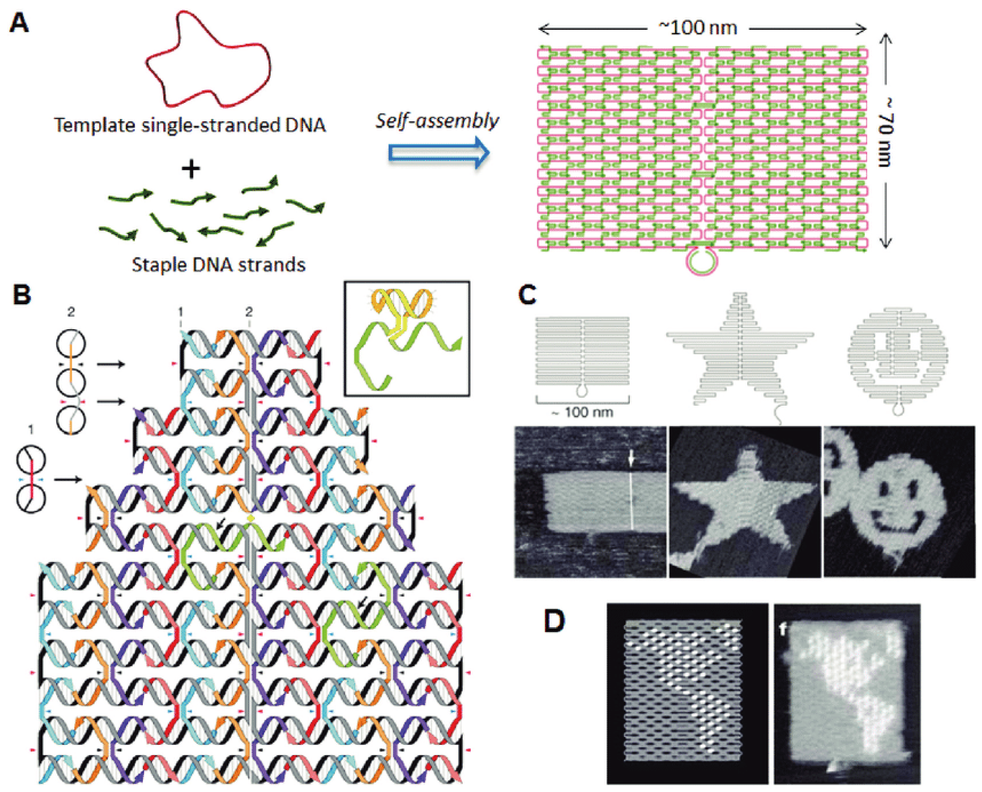

Fig.1 DNA origami structure [2]

History

- Necessity

Recently, cancer immunotherapy has shown positive results in clinical research and has become a standard treatment for cancer diseases. Cancer immunotherapy has the advantage of dramati-cally improving the recurrence and metastasis of cancer.

However, there is a clinical limitation that only 15 to 20 percent of all cancer patients can show therapeutic effects and cause se-rious side effects. To improve these problems, attempts are needed to improve the effectiveness of immunotherapy and reduce side effects by introducing biomaterials that have previ-ously been used in drug delivery or tissue engineering. [3]

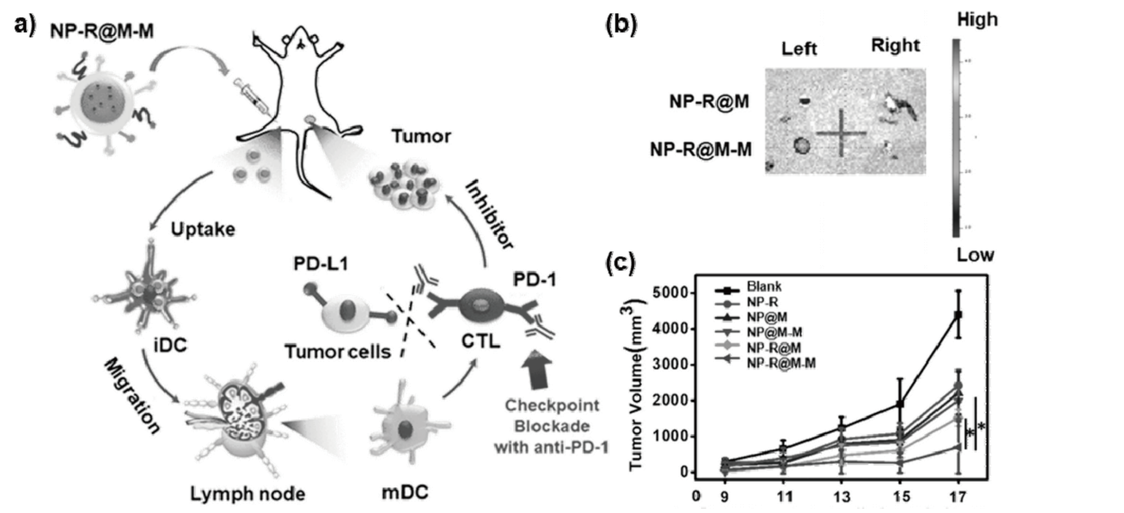

Fig.2 DNA origami structure [4]

(a) Nanoparticles with mannose modifiers target the dendritic cells and effectively deliver antigen and immune angiobonds to induce the maturation of dendritic cells.
(b) Imaging of lymph nodes in nanoparticles labeled Mannose.
(c) Effect of tumor suppression in functional nanoparticles.

- Formation

Among reported DNA nanostructures, tetrahedral DNA Nano-structures (TDN:composed of 4 oligonucleotides into a tetrahe-dral shape through bp) have been widely utilized for biomedical purposes and carried out by a thermal annealing process with all 4 dna oligonucleotides mixed together in a buffer. [5,6]

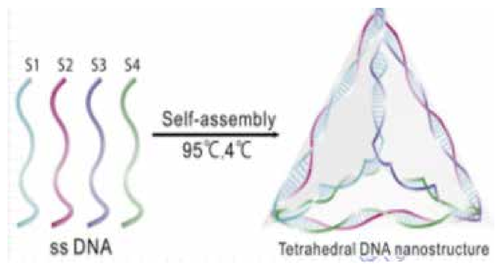

Fig.3 Tetrahedral DNA nanostructure

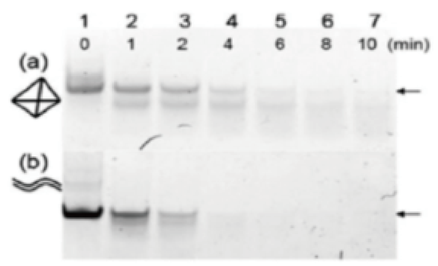

Fig.4 Structural integrity of TDN

Conclusion

DNA nanostructures can transmit proteins inside cells. It can be applied to the development of new protein drugs that target specific substances in cells.[7]

References

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