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POSTER

DNA origami nanobot for sensitive drug delivery chemotherapy

Minh Tri Luu, Shelley Wickham and Ali Abbas

The University of Sydney, 83 Boronia Rd, North St Marys, NSW 2760, Australia

Abstract

The cutting-edge technology of constructing nanoscale objects using DNA origami has opened new directions for drug delivery in cancer chemotherapy research [1, 2]. This project aims to develop a novel DNA origami nanobot for drug delivery, with high selectivity and specificity for chemotherapy. It is important to be able to control the rate of drug release to maintain the concentration of chemotherapeutic agents at the desirable set-point [3]. This control can be achieved through various activation methods, similar to those used in liposome drug delivery systems, e.g. magnetism, radiation, ultrasound, heating etc. [4]. These stimuli can deliver specific types of energy (e.g. thermal), which can then activate a pre-designed nanobot- topology variation. For example, thermal energy can cause local DNA strands to melt and partially distort some local regions of the DNA topology, releasing drug molecules. One mechanism to activate the drug release is via radio frequency (RF) electromagnetic wave induced heating of gold nanoparticles [6]. A prototype nanobot will be developed and tested for heat-triggered nanobot switching between open and closed configurations. It is hypothesized that upon RF heating, the gold nanoparticles will concentrate the heat and cause the local DNA strands to melt, leading to the open configuration, without melting the rest of the nanobot structure. Heating time and power will be tuned to regulate the drug release rate. This work will develop an effective process control strategy for enhanced performance of nanoscale drug delivery systems.

*For correspondence:

mluu2071@uni.sydney.edu.au

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