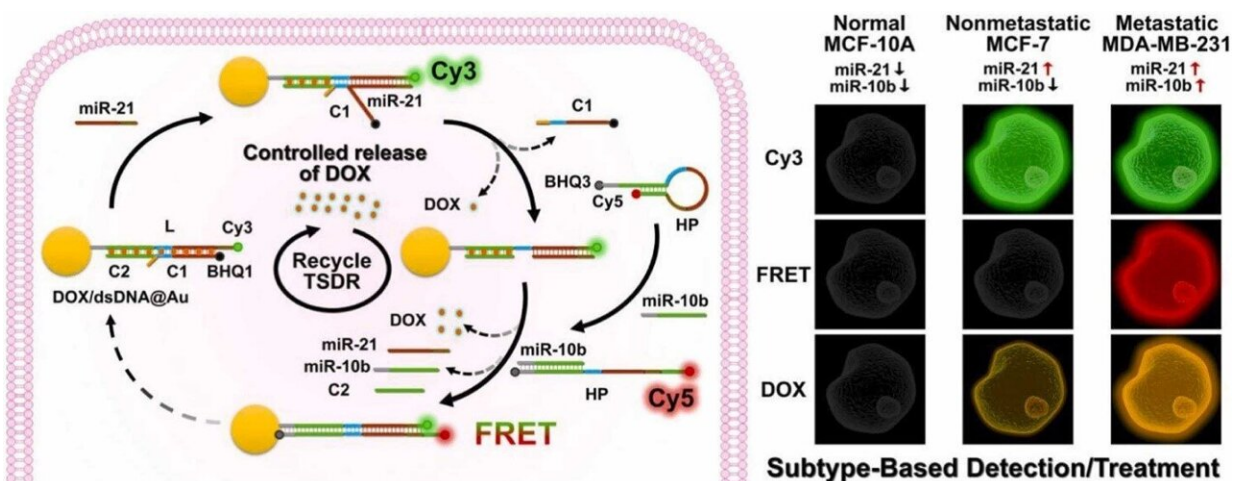# Dual-miRNA triggered DNA nanomachine for breast cancer subtype detection and treatment

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The dual-mirna triggered DNA-Au nanomachine based on toehold-mediated strand displacement reactions for controlled release of dox. Credit: Li S. M., Bi X., Yang F., et al.

Breast cancer is the most common malignancy in women, posing a serious threat to female health. Due to the high inter- and intra-tumoral heterogeneity of breast cancer, clinical treatment and prognosis can vary greatly in patients.

Currently, chemotherapy is the main systemic treatment for triple-

[negative breast cancer](#) (TNBC), a common type of breast cancer that does not have any of the receptors that are commonly found in breast cancer. However, treatment with the uniform high-dose chemotherapy regimen without molecular subtyping frequently yields suboptimal efficacy, adding further burden and discomfort to patients.

In a study [published](#) in *Biomedical Analysis*, a group of researchers from China outline a new discrimination and treatment approach—a dual-miRNA-triggered DNA-programmed nanomachine capable of imaging endogenous miRNA expressions. This approach makes subtype-based detection possible, thereby regulating [drug release](#) for chemotherapy.

"For the diagnosis and subtyping of breast cancer, histological examination of puncture biopsy sample is the 'gold standard,' but it is invasive and difficult to realize dynamic monitoring of tumor progression and prognosis for treatment guidance," explains the study's corresponding author Yun Xiang, a professor in luminescence analysis and molecular sensing at Southwest University.

"Fluorescence imaging techniques are capable of visualizing and monitoring minimal molecular changes occurring at an early stage of cancers with high resolution and sensitivity. However, single miRNA imaging is not suitable for discrimination of cancer cell types."

Notably, while previous studies have demonstrated that dual miRNA-triggered drug release can be applied for [cancer therapy](#) via the toehold-mediated strand displacement reactions (TSDR), tailored treatments, such as high-dose chemotherapy in TNBC and conventional-dose chemotherapy in other breast subtypes, have not been realized.

"We developed a DNA-programmed nanomachine for effective discrimination and tailored [treatment](#) of specific breast cancer cell types," says Shunmei Li, first author of the study.

"It is a responsive therapy strategy towards the various cell states. This intelligent nanomachine with controlled release of anti-cancer drug in specific cancer cell subtypes can reduce the side effect to normal cells and facilitate the targeted therapy, which is promising as a theranostics nanoplatform in precise medicine."