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Scientists in India & Australia develop precision nanoinjection platform for breast cancer drug delivery

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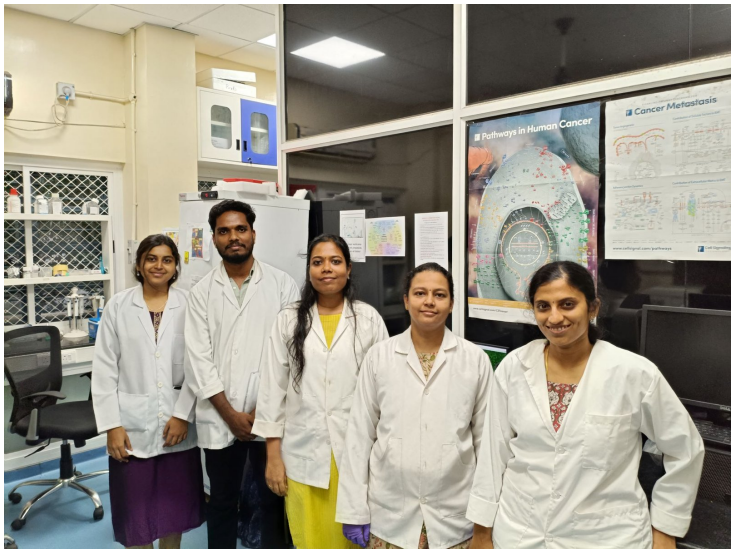
Breast cancer remains one of the leading causes of mortality among women worldwide



Researchers from the Indian Institute of Technology Madras (IIT-M), Monash University and Deakin University, Australia, have developed a cutting-edge nanoinjection drug delivery platform that has the potential to make breast cancer treatment safer and more effective.

The approach creates a precise and sustained therapeutic system that minimises damage to healthy cells by combining nanoarchaeosome-based drug encapsulation with silicon nanotube (SiNT)-based intracellular delivery.

Breast cancer remains one of the leading causes of mortality among women worldwide. Conventional treatments such as chemotherapy and radiation often harm non-cancerous tissues due to systemic drug exposure.

To overcome these limitations, the researchers from India and Australia have devised a nanoinjection system that delivers the anticancer drug doxorubicin directly into cancer cells using thermally stable nanoarchaeosomes (NAs) loaded into vertically aligned SiNTs etched onto a silicon wafer.

This integrated approach enhances the therapeutic efficacy of the drug while maintaining excellent biocompatibility.

Experimental results showed that the NAD-SiNTs (Nanoarchaeosome-Doxorubicin–Silicon Nanotubes) induced strong cytotoxicity against MCF-7 breast cancer cells, while sparing healthy fibroblasts.

The NAD-SiNTs triggered cell-cycle arrest and necrosis in cancer cells and significantly reduced angiogenesis, the process through which tumours develop new blood vessels, by downregulating key pro-angiogenic factors.

The platform demonstrated 23 times lower inhibitory concentration (IC50) than free doxorubicin, suggesting higher potency at

much lower doses, which can directly translate into lower treatment costs and fewer side effects.

The next phase of research will focus on in vivo validation, long-term toxicity studies, and regulatory assessments to prepare for preclinical and clinical translation.