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A targeted multi-stage theranostic platform for immunology

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Cancer vaccine often suffers from poor clinical efficacy due to the nature of antigen, vaccine formulation, and unfavorable tumor microenvironment. Here we report the development of a porous silicon microparticle (PSM)-based nanovaccine that induces tumor stromal changes and strong antitumor immunity in treating HER2 positive breast cancer. This HER2 nanovaccine elicited substantially increased intra-tumor MHCII expression, induced abundant CD11c+ cell infiltration, and produced robust anti-tumor immunity against established HER2 positive mammary gland tumors in a CD8+ T cell- dependent manner. It also inhibited spontaneous tumor development in Balb-neuT transgenic mice. Using ovalbumin (OVA) as a model antigen, we found that the nanovector-delivered OVA was preferentially enriched into early endosome and presented to T cells in a TAP-dependent fashion. Consequently, it elicited much stronger CD8+ T cell responses than soluble OVA. Taken together, PSM delivery of vaccination as well as utility in disease analysis provided an effective approach for producing strong anti-tumor immunity by promoting innate immune cell infiltration and transforming the tumor tissue from an otherwise immunosuppressive to an immunostimulating microenvironment.

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