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The effect of nanomedicines' size on targeting breast cancer cells within an engineered inert matrix of PEGDA

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The effort to develop cancer cell targeted therapies drives the search for the new generation of nanoscale drug delivery that is inherently multifunctional: combining active drug compound with selective targeting moieties. However, based on the differences between tumor and normal tissues in their structure, the challenge of delivering nanotherapeutics from the systemic circulation to cancer cell niche in the solid tumors is a major barrier. The objective of this work is to investigate the ideal nanomedicines' size for targeting breast cancer cells. The nanotherapeutics must transport from the systemic circulation to different sites of tumors by blood vessels, then cross the vessel wall, and finally, diffuse through the interstitial space to reach the cancer cell niche. In general, the typical size of nanotherapeutic systems is between 10 and 100 nm. In this range of nanotherapeutics size comes a range of pharmacokinetic and biodistribution parameters. We hypothesize that the size of nanotherapeutics matters in targeting cancer cells and nanotherapeutics within a size of 10-30 nm preferentially taken up by cancer cells. Silicon-based nanoparticles with size of 30, 50, 100 and 160 nm as well as Si-carbon quatum dots with a size of 10 nm are used in this experiment. Because of the difficulty to probe nanotherapeutics flow through ECM *in vivo*, poly ethylene glycol diacrylate (PEGDA) hydrogel with a specific stiffness is used to mimic the transport of nanotherapeutics into the tumor and to maintain cancer cells and tumorspheres formation. Fluorescence microscopy and quantitative assays were used to investigate the cellular uptake of Si-labeled FITC nanoparticles.

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