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Tunable amphiphilic diblock copolymers with enhanced drug loading capacity and their toxicity evaluation through microfluidics

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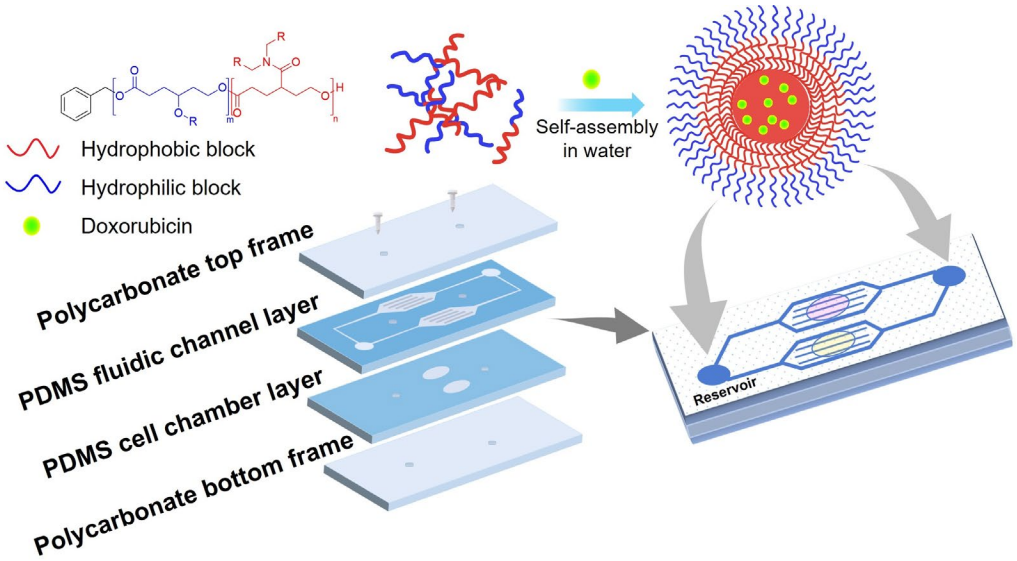
Amphiphilic diblock copolymers were synthesized by the ring-opening polymerization of various g-substituted e-caprolactone monomers and self-assembled into the water to form micelles, which can improve the loading of anticancer drugs. The drug-loaded micelles can passively target tumors through an enhanced permeability and retention (EPR) effect. Our research has been focused on two strategies to increase the drug loading capacity of the amphiphilic diblock copolymer micelles: a) tuning substituents at the hydrophobic polycaprolactone block, and b) co-loading with polyphenols, such as resveratrol and quercetin, when benzyloxy substituents were employed at the hydrophobic polycaprolactone block. The non-covalent interaction, such as p-stacking and hydrogen bonding interaction between the anticancer drug, doxorubicin, and polyphenol, can increase the drug loading capacity. The co-loading approach can significantly reduce the cardiotoxicity caused by the anticancer drug. Moreover, we reported a microfluidic device to cultivate stem cell-derived organoids to simulate the dynamic microenvironment of the organ and test the toxicity of drug-loaded micelles. The cell-cell and cell-matrix interactions found in living organs can improve the evaluation of *ex vivo* toxicity of drug-loaded micelles.



Amphiphilic diblocck copolymers and their toxicity evalution using organ-on-chip.