

Bioinspired Nano/Micro Drug Delivery System for Diseases Treatment

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There are many insurmountable inadequacies for traditional therapeutics and disease treatments, including low biocompatibility, poor therapeutic efficacy, and high toxicity induced by the off-targeting effect and inopportune spatiotemporal drug release profile. To overcome these obstacles, bioinspired nano/micro drug delivery systems (DDSs) are attracting more and more attention among scientists and engineers because they can serve as “Trojan horses” to escort the drug to the target tissue with higher efficacy and lower side effects, by targeting to the specific receptors and responding to the special microenvironmental cues in the site of diseases. The DDSs can effectively and efficiently regulate the distribution of drugs in organisms spatiotemporally to achieve targeted delivery, controlled release, and reduced toxicity/side effects. Advanced DDSs are closely integrated with materials science and nanotechnology, and are usually presented in the form of formulations such as nanoparticles (NPs), polymeric micelles (PMs), lipid nanoparticles (LNPs), and microneedles (MNs).

We have designed and prepared different bioinspired nano/micro drug delivery systems, including NPs^{1,2}, PMs³ and MNs^{4,5}, with high targeting effect and satisfied drug release profiles for improved diseases treatment like cancer, infection and inflammation. For instance, we prepared pH-responsive BSA-based NPs to specifically target to the inflammatory neutrophil *in vivo*, followed by inducing the premature apoptosis for “cytokine storm” related diseases treatment like stroke. Considering the acute lung infection, we designed and fabricated pH- and enzyme-responsive NPs which can target to the infectious site via CD54 and respond to the high acid level and bacterial enzyme to release the cargos on-demand. We also developed bioinspired MNs which can effectively deliver chemical drugs, peptide and protein to the skin for diseases treatment like atopic dermatitis and wound healing.

References:

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