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SUPRAMOLECULAR ASSEMBLIES OF SMART BLOCK COPOLYMERS AS NANOCARRIERS FOR GENE AND DRUG DELIVERY: CHALLENGE TO INTRACELLULAR NANOMEDICINE

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Polymeric micelle, the self-assembly of block copolymers with core-shell architecture, is a promising nanocarrier for drug and gene delivery. There are several relevant properties in polymeric micelle as nanocarrier systems, such as longevity in blood circulation, tissue-penetrating ability, spatial and temporal controlled drug release, and reduced inherent toxicity. Also, engineering of the block copolymer structure allows the preparation of polymeric micelles with integrated smart functions, such as targetability as well as stimuli-sensitivity. This presentation overviews the recent achievements as well as the future perspectives of polymeric micelles as smart nanocarriers for drug and nucleic acid delivery. Notable anti-tumor efficacy against hypovascular cancer, including pancreatic cancer and diffused-type stomach cancer, of the doxorubicin-incorporated polymeric micelles with pH-responding property will be demonstrated to emphasize a promising utility of the nanocarrier-modulated chemotherapy for the treatment of intractable cancers. Then, the focus of the talk will be placed to the application of gene-loaded polymeric micelles as non-viral vectors in the field of regenerative medicine, particularly bone regeneration. The result using micellar nanocarrier systems will be demonstrated for the successful generation of new bone in experimental animals by transducting genes encoding differentiation factors. Further, the future perspective of supramolecular nanodevices, including polymeric micelles, polymer vesicles, and photosensitive dendrimer assemblies, will be featured in the last part of this presentation, directing to the new medical paradigm of smart nanotheranostic systems controlled by external physical stimuli, particularly, photoillumination (nano-photomedicine).