Nucleic Acid-based Biomaterials and Their Applications

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Nucleic acid-based architectures have fascinated researchers in the material field. With the understanding of the chemical and structural nature of nucleic acids, they have been designed and fabricated from two- to three-dimensional structures. Especially, DNA has been utilized successfully as a building block in a finely organized and controlled manner. Here we report various nucleic acid-based materials that can be used for many applications such as sensing, tissue engineering, or drug delivery. A new method for creating polymerized DNA or RNA is used to generate pre-programmed polymeric DNA or RNA sequences that spontaneously assemble into nanoscale structures that form DNA microspheres, DNA hydrogel, a sponge-like RNA microsphere, and RNA membranes. These nucleic acid biomaterials are applicable not only for delivering nucleic acid drugs including small interference RNA or small drugs such as chemotherapy drugs but also for constructing 3D materials.