Journal of Nanomedicine & Biotherapeutic Discovery

Lee, J Nanomedine Biotherapeutic Discov 2014, 4:2
DOI: 10.4172/2155-983X.1000e133

Editorial Open Access

Nanoparticle-assisted Controlled Drug Release

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Can Nanomedicine innovate therapeutic methods and enhance medical understanding in line with traditional medicine? What should the goal of Nanomedicine be, either to open new markets or to improve current medical approaches? Those kinds of questions arise whenever we do Nanomedicine related researches. Even though many questions regarding nanoparticles including safety and uniform synthesis remain still unclear, nanoparticles-based Nanomedicine is increasing its areas, especially in controlled release [1].

Controlled release assisted by nanoparticles can enhance controlled release properties and add more smart properties by combining diverse nanoparticles' properties. The goal of controlled release is to release drugs and biological materials to the specific location and time by limiting side effects from high systemic or off-target exposure. However, many obstacles like rapid clearance and blood barrier should be overcome to achieve the goal, which may be through an extremely hard and complicated process. Controlled drug release systems are mostly composed of polymeric systems as led by Langer's group [2] due to the robust and controllable physical properties of polymer for an extended period of time. However, engineering polymeric system for controlled drug release can be limited due to the unique physical properties of polymers. In contrast, liposome or inorganic nanoparticles demonstrate their various properties like magnetic, light, heat, and pH sensitive properties depending on basic materials and surface modifications [3]. Therefore, hybrid system with nanoparticles and conventional controlled drug release system (e.g., iron oxide nanoparticle + drug loaded polymeric gel) can improve controlled drug release by further minimizing side effects and incorporating some smart properties.

Even though a great blossom in Nanomedicine has been observed in many areas, still a lot of people doubt its roles and applications; especially in targeted drug delivery area because its target-to-non-target ratio is not high enough and high vital organ (e.g., liver and spleen) accumulation compensates its benefit to passive tumor target. To avoid these downside aspects, it is emerging to use nanoparticles as assisted materials for conventional drug delivery system, not as a nanodrug carrier. Among them, hybrid system combining inorganic nanoparticles and polymeric materials (e.g., iron oxide nanoparticle+liposome+polymer gel) will grow its territory due to rapid and easy formulation, still using conventional and old drugs [4]. Eventually the hybrid system can be developed to monitor cell signals and release drugs based on that to challenge complex biological system and disease.

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Received July 25, 2014; **Accepted** July 28, 2014; **Published** July 30, 2014

Citation: Jae-Ho Lee (2014) Nanoparticle-assisted Controlled Drug Release. J Nanomedine Biotherapeutic Discov 4: e133. doi:10.4172/2155-983X.1000e133