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PREFACE

Nano-sized Materials for Tissue Regeneration and Immune/Cancer Therapy

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Nano-sized materials have been attracted attention in recent years due to their attractive bio-applicable property for tissue regeneration [1]. Additionally, nano-sized materials have been used to boost up immune cells for immune/cancer therapy in terms of targeting cancer and destroying cancer [2, 3]. Within this interest to nano-sized materials, development and application of nano-sized materials for tissue regeneration and immune/cancer therapy had been dramatically progressed within a decade. Despite of the advance of nano-sized materials, unsolved problems such as efficacy of cancer targeting, unpredictable side effects in immune/cancer therapy, and safety issue for tissue regeneration are still remained [4].

In this special issue, we introduce the recent strategy and method for tissue regeneration and cancer immunotherapy using nano-sized materials to overcome the conventional limitations. Shin et al. reviewed the functional nanoparticles for controlling tumor microenvironment (TME). TME is composed of hypoxia, acidity, dense extracellular matrix, and immunosuppression, and it is closely associated with tumor development, progression, metastasis, and drug resistance. Shin et al. straightened the TME-tailored nano-sized particle strategies to reduce side effects and to enhance precise drug delivery to tumor [5]. Next, Ko et al. provided an overview on controlling of immune microenvironment by using nano-size material-derived biomaterials for enhancing tissue regeneration. Due to immune reactions at the targeting site, conventional approaches for tissue regeneration are interfered. In this background, the regenerative immune engineering has been emerged as a novel approach for tissue regeneration by modulating the immune system. Ko et al. introduced the recent technology or immune engineering methods for tissue engineering in terms of cell types and biomaterials [6]. Phan et al. reviewed the recent progress of nano-sized enzyme mimicking particles for boosting up cancer immunotherapy. Nanozyme, a catalytic nanoparticle with natural enzyme-mimicking properties, has advantages related to roles as a drug carrier for cancer treatment and enzyme modulating immunosuppression of the TME via the catalytic activities. Phan et al. [7] introduced the use of nanozymes for inverting immunosuppressive pro-tumor TME to immunoactive anti-tumor TME by controlling reactive oxygen species. Skeletal muscle possesses an innate regenerative capacity to restore their structure and function following acute damages and injuries. However, in congenital muscular dystrophies, large volumetric muscle loss, cachexia, or aging, the declined regenerative capacity of skeletal muscle results in muscle wasting and functional impairment. Jeong et al. [8] focused on the recent studies leveraging nano-sized materials for regeneration of skeletal muscle. They looked at skeletal muscle pathologies and described the various proof-of-concept and pre-clinical studies that have used nanomaterials, with a focus on how nano-sized materials can be used for skeletal muscle regeneration depending on material dimensionality. Furthermore, some of the outstanding concerns and future directions for improving therapeutic efficacy of nano-sized material-based therapeutics were also discussed. Seo et al. reviewed the progress of hydrogel-based drug delivery strategies for cancer immunotherapy. Despite of potency and advantages of cancer immunotherapy, it still exists

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several safety and efficacy issues such as autoimmune reaction, cytokine release syndrome, and vascular leak syndrome. By the needs of solving these problems of cancer immunotherapy, biomaterials like hydrogel have drawn attention. Seo et al. reviewed the functional hydrogels for cancer immunotherapy and explained the mechanism to apply hydrogels in cancer immunotherapy. Furthermore, they also discussed the current problems and suggested the future direction of hydrogels for cancer immunotherapy [9]. Kim et al. examined the method for enhancing drug loading efficiency of hyaluronic acid hydrogels by adding dopamine. They described the dopamine that could delay gelation time of photo-crosslinkable norbornene-modified hyaluronic acid hydrogel without changing the final storage modulus of the hydrogel. They also showed that dopamine in the hyaluronic acid hydrogel increased the loading efficiency of doxorubicin, which is well-known anti-cancer drug, strengthening the application of hyaluronic acid hydrogel for targeting tumor with anticancer drug loading and cellular uptake [10]. Park et al. examined the metal ion releasing gold nano-sized particles for killing tumor with photothermal effect and enhancing the tumor targeting property using human mesenchymal stem cells (MSC). Nanoparticles upregulate the MSC migration and viability under hypoxic condition. Furthermore, nanoparticle-treated MSC showed significantly enhanced the tumor targeting efficiency and photothermal effect. The combined method based on nanoparticles and stem cells may provide new platform for targeting and killing tumor [11]. Gwon et al. described the fabrication method of small gelatin nanoparticles for biomedical applications. They explained the new freezing-and-thawing method for manufacturing small and stable gelatin nanoparticles having 100 nm size. They also emphasized the fast drug release rate without toxicity which could apply for efficient drug delivery and tissue engineering [12]. Lastly, Kim et al. demonstrated the structural-physical relationship of the hydrogels by controlling component. They described about how the concentrations of polymeric contents and initiators influence physico-chemical properties of thiolated gelatin/polyethylene glycol diacrylate hydrogels. They also addressed that controlling of hydrogel could be utilized in tissue engineering fields [13].

This special issue serves to depict the current landscape of nano-sized materials development to improve tissue regeneration and immune/cancer therapy. We expect to provide new aspect and novel approach for tissue engineering and cancer therapy using nano-sized materials.

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