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Editorial

Polymeric Biomaterials for Tissue Engineering Applications 2011

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The interdisciplinary field of biomaterials and tissue engineering has been one of the most dynamic and rapidly expanding disciplines in the past two decades. Polymers are very attractive and useful in this area because of their tailorable chemical structures and physical properties. Many noncytotoxic and biodegradable polymers have been fabricated into medical devices for diverse applications, including tissue repair, drug delivery, cancer therapy, and nonviral gene therapy. Novel synthetic, supramolecular, and biomimetic strategies have been developed for advancing exploration of polymeric biomaterials. By tuning polymer structural parameters and morphologies at different length scales, controllable physical properties can be achieved for satisfying diverse clinical needs and regulating cell behavior. Polymeric biomaterials can also be incorporated with natural materials and inorganic nanoparticles to obtain novel, unique, and synergetic properties for better performance.

The aim of this annual special issue is to highlight recent significant developments in the synergy between material design strategies and biological evaluations through contributions from active researchers in the field. The first special issue was launched in 2010, and it proved to be very successful. The nine papers in that issue have garnered ten citations in one year according to Web of Science. This special issue has thus become an annual special issue to be published each year. Such a series can have a long-term impact and in time gather a community around it. The 2011 issue here covers various topics related to polymeric biomaterials for tissue engineering applications. Five original research articles and four reviews are included to stimulate the continuing efforts in developing novel polymeric systems, which is crucial to improve our fundamental understanding of cell/tissue-material interactions and tissue repair and regeneration. The editors of this annual special issue make every effort to ensure rapid and high-quality review process. The elapsed time for each accepted paper in this issue ranged from 24 to 54 days with an average value of 44.4 days.

Aliphatic polymer esters such as poly(L-lactide) (PLLA), polyglycolide (PGA), and their copolymers are widely used in tissue engineering applications. In the first paper "*Fast and convenient synthesis of amine-terminated polylactide as a macroinitiator for ω-benzyloxycarbonyl- L-lysine-N-carboxyanhydrides*" M. Ju et al. report synthesis of amine-terminated PLLA (NH_2-PLLA) with different molecular weights and then polymerization of ω-benzyloxycarbonyl-L-lysine-*N*-carboxyanhydrides using NH_2-PLLA as a macroinitiator. *In vivo* biocompatibility was also evaluated by implantation of the block copolymer and NH_2-PLLA in nude rats.

Polyhydroxybutyrate (PHB) is a semicrystalline degradable biomaterial produced by microorganisms. Its brittle nature and high crystallinity limit its potential tissue engineering applications. In the second and third papers "*Application of polyethylene glycol to promote cellular biocompatibility of polyhydroxybutyrate films*" and "*Manipulation of*

polyhydroxybutyrate properties through blending with ethyl-cellulose for a composite biomaterial" R. T. H. Chan et al. report modification of PHB by blending with poly(ethylene glycol) (PEG) and ethyl-cellulose (EtC), respectively. Both PEG and EtC can decrease PHB crystallinity. Neural-associated olfactory ensheathing cells were found to attach and proliferate better on PEG-modified PHB films while did not change on EtC-modified ones.

Fiber-reinforced polymer composites can be engineered for specific tissue performance, in particular, bone repair. On a per-weight basis, their mechanical properties can be many times greater than structural aluminum, titanium, or steel. In the fourth paper "*Bisphenyl-polymer/carbon-fiber-reinforced composite compared to titanium alloy bone implant*" R. C. Peterson reports aerospace/aeronautical thermoset bis-phenyl-polymer/carbon-fiber-reinforced composites, aiming to replace metal bone implants. They also performed *in vivo* bonemarrow tests with Sprague-Dawley rats and examined osteoconductivity of the polymer composites compared to titanium alloy controls.

Chitosan, a copolymer of D-glucosamine and *N*-acetyl-D-glucosamine, is a biodegradable polysaccharide obtained from *N*-deacetylation of chitin, which can be extracted from the shells of crabs and shrimps. Chitosan has been used as biocompatible wound dressings and also has intrinsic would-healing abilities. In the fifth paper "*In Vitro evaluation of a biomedical-grade bilayer chitosan Porous Skin regenerating template as a potential dermal scaffold in skin tissue engineering*" C. K. Lim et al. report a method to prepare a biomedical-grade bilayer chitosan porous skin regenerating template as a potential dermal scaffold. Cultured primary human dermal fibroblasts were able to penetrate the scaffold, and pore sizes between 50 and 150 μm were found to be cytocompatible, as indicated by no additional production of interleukin-8 (IL-8) and tumor necrosis factor-α (TNF-α).

Review articles in this issue cover different aspects in scaffolds and hydrogels for tissue engineering applications. In the sixth paper "*Polymeric scaffolds in tissue engineering application: a review*" B. Dhandayuthapani et al. give an overview of different types of scaffolds, materials properties, and fabrication techniques. The seventh paper "*Hydrogel contact lens for extended delivery of ophthalmic drugs*" contributed by X. Hu et al. summarizes hydrogel contact lenses for extended delivery of ophthalmic drugs. Strategies to modify the conventional contact lenses as well as novel contact lenses are discussed. In the eighth paper "*Poly(amidoamine) hydrogels as scaffolds for cell culturing and conduits for peripheral nerve regeneration*" F. Fenili et al. review biodegradable poly(amidoamine) hydrogels as scaffolds for cell culturing and conduits for peripheral nerve regeneration. The last paper of this issue "*Hydrogel synthesis directed toward tissue engineering: impact of reaction condition on structural parameters and macroscopic properties of xerogels*" contributed by B. Adnadjević and J. Jovanović discusses xerogel preparation and impact of reaction condition on structural parameters and macroscopic properties after a brief review of applications of hydrogels in tissue engineering.

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