Preface

Biomedical polymers are one of major biomaterials, which make devices that are frequently indispensable for maintaining human health, improving patient life quality and saving lives. They also facilitate innovative therapeutic technologies thereby reducing treatment expenses. As the clinical use of biomaterials involves direct interaction with such human physiological systems as blood, tissues and cells or with such constituents as proteins, enzymes, nucleic acids, polysaccharides, inorganic salts and various types of small molecules, biomedical polymer research tends to be highly interwoven with material science, biotechnology and medicine. One of the primary characteristics of biomedical polymeric materials is their bio-functionality, which renders them capable of being used as diagnostic and replacement and repair of disabled organs and damaged tissues. Another key point is biocompatibility, which means the biomedical polymers should be compatible with tissues and blood fluids and do not trigger undesirable reactions. The development of clinical medicine directly benefits from progress in biomaterials science. For example, various types of biomedical polymer materials have been widely used in interventional diagnostic systems, therapeutic devices, controlled drug delivery systems, dressings for trauma and burns, intravascular stents and artificial joints and prostheses. However, biomedical polymer material research and development is correlated to such other disciplines as chemistry, material science, biology, medicine, physics, in frequently complex interactions.

The ideal research pattern is close combination of basic research with subsequent industrialization. For biomedical polymeric materials, the formulation of a new material or a new design often initiates fundamental changes in the biomaterial industry. For example, the commercialization of pacemakers and heart valves stimulated a market of about 4 billion dollar in 2001. The demand for biomaterials, particularly biomedical polymeric materials has substantially increased. The commercial market for biomedical materials products, implants and devices in contact with physiological systems exceeded 50 billion dollar in 2002, which maintained an annual growth rate of about 15% to 20%. The

polymer biomaterial market was estimated to 100 billion dollar in 2007, which contributed to more than 40% of the market for medical devices. Biomedical polymer material research in China was pioneered by Professor FENG XinDe of Peking University and Professor HE BingLin of Nankai University in the late 1970s. Since their breakthrough work, research centers and institutions have been established with the support of the National Natural Science Foundation of China (NSFC), the Chinese Ministry of Science and Technology (MOST), and local governments. Various types of biomedical polymers have been studied, which include, but are not limited to, drug and gene delivery systems, tissue engineering and regenerative medicine scaffolds, diagnostic devices and blood contact materials. The achievements of the above studies have had a global scientific impact, with commercially viable products shipping on an industrial scale.

For this special topic, leading Chinese biomedical polymer researchers have been invited to present their recent work, in order to illustrate current Chinese biomedical polymer research. The present issue contains both reviews and research papers, focusing on stimulus responsive polymeric nanoparticles, peptide dendrimers, hydrogels of silk fibroin for tissue regeneration, drug and gene delivery systems based on hyperbranched polymers, layer-by-layer assembly, cyclodextrin, amphiphilic block copolymers, nano-imaging agents, and NO *in situ* release of blood compatible materials.

As an interdisciplinary science, the research and development of biomedical polymers continuously derives ideas, methods, and technologies from other research fields. The knowledge, results and techniques derived from supramolecular science, nanotechnology, biology and medicine have been adopted as key factors in the design and development of biomedical polymers and devices that have unique functions and applications. Advanced cellular and molecular biology technology has been utilized for evaluating the biological performance of biomaterials, facilitating the understanding of their biological responses in clinical trials. Life science and biomaterial technology and techniques make possible such “living” biomedical devices as

stem cells based on regenerative materials.

Biomedical polymer materials are typically used alone or in combination with other materials and techniques in biological and medical applications. Therefore, target-driven research is essential, in order to efficiently commercialize innovative devices for clinical use.

We would like to express our deep appreciation to Editorial Director, Dr. ZHU XiaoWen, for her outstanding work in planning, organizing and editing, so that the papers might be published in "*SCIENCE CHINA Chemistry*" in a relatively short period of time. We would also like to thank all of the authors contributing to this issue. Due to limited time, we sincerely regret that there were excellent manuscripts

which may not be able to include in this special issue. We greatly appreciate any constructive comments or suggestions from readers.

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Professor GAO ChangYou received his Ph.D. (1996) in the field of polymer chemistry and physics from Jilin University under the supervision of Profs. SHEN JiaCong and YANG Bai. He worked in the Department of Polymer Science and Engineering of Zhejiang University as a post-doctoral fellow from 1996 to 1998, before joining the faculty as an associate professor from 1998 to 2001 and as a full professor since 2002. He was a principal investigator for the National Science Fund for Distinguished Young Scholars of China (2004), and was appointed as a Changjiang Scholar by the Ministry of Education (2007). His research interest is biomedical materials for tissue engineering and regenerative medicine. Since 2008 he has been an editorial board member of *SCIENCE CHINA Chemistry*.

Professor GU ZhongWei received his baccalaureate and masters degrees in Polymer Science from Peking University, prior to serving as a senior visiting scholar in the Research Triangle Institute, RTP and the University of Utah, respectively from 1984 to 1986 and 1991 to 1993. He was appointed as a professor in 1994, and presently serves as the chief scientist of the National Basic Research Program of China (the 973 program), Director of the National Engineering Research Center for Biomaterials at Sichuan University, Vice-Chairman & Secretary-General of the Chinese Committee for Biomaterials (CCBM), and is a fellow of Biomaterials Science and Engineering (FBSE). His current research activities focus on the molecular design and controlled preparation of novel biomedical polymers and nano-biomaterials, vectors for gene therapy, polymeric carriers and controlled drug delivery systems, biomaterials for molecular diagnosis, and biodegradable scaffolds for tissue engineering.