Acknowledgment

Review Committee

Mario Barbosa, Van Blitterswijk, W. Bonfield, J. D. Bruijn, Laurence C. Chow, Cliford W. Colwell, Guy Daculsi, John Davies, Klaas de Groot, Darryl D. D'Lima, Paul Ducheyne, Jonathan Garino, L. L. Hench, Kunio Ishikawa, J.A. Jansen, ILKKA Kangasniemi, Cheol Y. Kim, Hyun-Min Kim, Sukyoung Kim, Tadashi Kokubo, Kenji Kurashina, Pierre Layrolle, Racquel LeGeros, Jacques Lemaitre, Yang Leng, Betty Leon, Panjian Li, Shihong Li, Peter Liao, Nancy Lin, Helen H. Lu, Peter X. Ma, Michael Manley, J. Patricie Merkert, Antonio Moroni, Takashi Nakamura, Besim Ben Nissan, Hajime Ohgushi, Chikara Ohtsuki, Hironobu Oonishi, Akiyoshi Osaka, Ron Overholser, Russell Parsons, Hugo Pedrozo, Bob Pilliar, Rui L. Reis, Tithi Dutta Roy, Gary E. Schumacher, Carl G. Simon Jr., Drago Skrtic, Limin Sun, Shozo Takagi, Kevor TenHuisen, Aliassghar N. Tofighi, Wei Dong Tong, Paolo Tranquilli-Leali, Ming S. Tung, Jian-Sheng Wang, Min Wang, Rizhi Wang, Mei Wei, Michael Weir, Hai Bo Wen, Elizabeth A. Wilder, J. Wolke, Hockin H. Xu, Sophie Yang, Huipin Yuan, Kai Zhang, Xingdong Zhang

Financial Support

DePuy, Inc., a *Johnson & Johnson* company

Stryker Orthopaedics

Zimmer Inc.

Smith & Nephew Orthopaedics

CeramTec

Cam Implants, B.V.

Oxford Instruments Analytical

Endorsements

European Society for Biomaterials

Japanese Society for Biomaterials, The Ceramic Society of Japan

Preface

This book is comprised of the papers presented at the 17th Annual Meeting of the International Society for Ceramics in Medicine (ISCM) held on December 8 – 12, 2004 in New Orleans, Louisiana USA. It reports the most recent progresses made in the study of bioceramics and its application in medicine, especially in repair of bone defects. The ever-increasing impact of bioceramics is reflected within this book.

Ceramics have been successfully used in clinical medicine. Calcium phosphate ceramics including hydroxyapatite and other calcium-based ceramics represent those ceramic materials that are designed and synthesized for treatment of bone defects. Plasma-sprayed HA coatings are being used on joint and dental implants to improve integration of these devices to bone. The cements composed of calcium phosphates have proven to be an effective bone substitute. Alumina and zirconia ceramics have been used to make hip heads, acetabular cup liners, and knee implant components. Bone and cartilage tissue engineering and also controlled drug delivery requires an appropriate scaffold and delivery vehicle. Bioceramics could offer great advancements for such applications.

There is growing interest in taking engineering principals from the natural world and applying them in the development of new products or in the modification of existing products for better overall performance. This emerging field of science is now known as biomimetics. Inspired by bone mineralization, scientists have successfully developed new technology that would allow for the large-scale production of apatite coating from an appropriate aqueous solution at ambient temperatures. The biomimetic apatite could be significantly equivalent to bone mineral in composition and structure if the coating source solution mimics the physiological solution in the body. The front page of this book shows the biomimetic apatite coating that covers the entire surface of individual beads in the porous ingrowth layer of joint implants. This osteoconductive 3-D biomimetic apatite coating is superior to the plasma-sprayed hydroxyapatite coating used today and would exemplify the recent advancement of bioceramics study. The Si-substituted apatite disclosed in this book is another example of the latest progress made in the field of bioceramics.

The invention of the first bond-bonding glass by Dr. Hench and his co-workers represents the new area of bioceramic study. Following Dr Hench's findings, Dr. Kokubo and Dr. Nakamura have conducted extensive research in apatite formation on the surface of bioactive glasses and ceramics *in vitro* and *in vivo*. Their works formed the bases in design and preliminary tests of new bioactive materials. The findings that hydrated silica and titanium oxide gel are capable of inducing apatite formation lead to the exploration of new surface treatments to make titanium and other metallic materials bioactive.

Many others have followed the pioneering work of Dr. Bonfield and his associates on composite materials comparable to bone, in the development of new composites and hybrids as bone replacements and tissue engineering scaffolds. This book collects many papers on calcium phosphate cements. The early findings on calcium phosphate cement by Dr. Chow and his co-workers have inspired many other scientists to study various cements based on

different calcium phosphates and have lead to the development of new biodegradable calcium phosphate cements used in the regeneration of bone. The concept of using hydroxyapatite or other calcium phosphate ceramics to improve the bioactivity of non-active metal implants and devices was initially reflected in one paper published by Dr. Ducheyne and his co-workers. Dr. de Groot is the one of the few pioneering scientists in the world researching calcium phosphate-based bioceramics. His successful commercialization of calcium phosphate bioceramics and plasma-sprayed HA coating has demonstrated that the successful professor can also be a successful entrepreneur. The creation of jobs is as important as the publication of papers to our society.

The FDA approval on the use of a ceramic head against a ceramic acetabular cup liner indicates the growing acceptance of bioceramics by the surgical community. The realization of the great potential of bioceramic in reconstructive medicine has begun. With this promising future, more research is needed in order to determine the stability and reliability of the ceramic device under specific conditions to which they could be exposed.

Like previous meetings, Bioceramics 17 is intended to serve as a platform where our colleagues will share their latest results, discuss their problems, and envision the future of bioceramics. This book is anticipated to provide valuable information for scientists, engineers, and surgeons in the study, manufacture, and clinical application of bioceramics. We hope that Bioceramics 17 could lead to new findings and inventions that would be presented in future bioceramic meetings.

We would greatly appreciate the contributions of the Executive, International and Local Organizing committees. We wish to express our sincere thanks to the review board who reviewed the abstract and manuscripts in a timely fashion. We would like to thank Stryker Corporation, CAM Implants, CeramTech, and Oxford Instruments Analytical for the financial support. It would have been impossible to organize and publish Bioceramics 17 without the contribution and support of DePuy Inc., a Johnson & Johnson company to whom we wish to express our gratitude.

Panjian Li, Ph.D. Kai Zhang, Ph.D. Clifford Colwell, Jr. M.D.