Editorial

Mark J. Jackson

Center for Advanced Manufacturing,
College of Technology, Purdue University,
West Lafayette, Indiana IN 47907-2021, USA
E-mail: jacksomj@purdue.edu

Nicholas Dunne*

School of Mechanical and Aerospace Engineering,
Queen's University Belfast,
Belfast, BT9 5AH, UK
E-mail: n.dunne@qub.ac.uk
*Corresponding author

Janet Hill

Clinical Outcomes Unit, Musgrave Park Hospital,
Belfast, BT9 7JB, UK
E-mail: janet.hill@belfasttrust.hscni.net

Fraser Buchanan

School of Mechanical and Aerospace Engineering,
Queen's University Belfast,
Belfast, BT9 5AH, UK
E-mail: f.buchanan@qub.ac.uk

Biographical notes: Mark J. Jackson is Associate Head of Department for Research and University Faculty Scholar at Purdue University, Indiana, USA. He has published over 100 peer-refereed journal papers, contributed book chapters to eight books on biomaterials and manufacturing and is series Editor of the nano-manufacturing series for Oxford University Press. He is a Chartered Mechanical Engineer with the Institution of Mechanical Engineers and the Institute of Materials, Minerals and Mining, UK. He is a Visiting Professor at Harbin Institute of Technology, China, and is a Research Associate at the Y12 plant of the Oak Ridge National Laboratory, Tennessee.

Nicholas Dunne is a Senior Lecturer in Mechanical and Aerospace Engineering at Queen's University of Belfast. He has authored over 70-refereed papers and contributed book chapters on mixing, delivery and management of calcium phosphate and acrylic based cement systems. He is a Chartered Engineer and Fellow of the Institute of Materials, Minerals & Mining. He has been awarded the IMechE Duncan Dowson Medal, an Orthopaedic Research Society/British Orthopaedic Research Society Fellowship (2009) and the Royal Academy of Engineering/Leverhulme Trust Senior Research Fellowship Awards (2010) recognising him as a significant contributor to orthopaedic bone cements

research. More recently he has developed a research program on tissue engineered constructs for hard tissue replacement.

Janet Hill is a Senior Biomechanics Engineer at the Clinical Outcomes Unit in Musgrave Park Hospital, Belfast. She received her doctoral qualification in Biomaterials from Queen's University of Belfast in 2006. In 2005, she received a travel award from Royal Academy of Engineering (UK) to attend the Nanocomposite Polymers Research Group at Cornell University, which is headed by Professor Emmanuel Giannelis. Her current research interests include biomaterials and biomechanics relating to joint replacement surgery.

Fraser Buchanan is a Reader in the School of Mechanical and Aerospace Engineering at Queen's University of Belfast and has been involved in various aspects of materials degradation research for the past 20 years. His research has more recently focused on biomaterials such as calcium phosphate ceramics and bioresorbable polymers. His current research on calcium phosphates focuses on injectable calcium phosphate cements and development of naturally derived bioresorbable calcium phosphates. His research on bioresorbable polymers currently focuses on synthetic biocompatible polymers (e.g., aliphatic polyesters) such as polylactic acid (PLA) and polyglycolic acid (PGA).

Since Sir John Charnley introduced acrylic-based bone cement for joint replacement surgery nearly 50 years ago, it has been used widely throughout the world. During this time, our understanding of the properties and use of bone cement have increased. The users of cemented joint replacement need to know the chemical and physical properties of bone cement, which change by even slight variations in the chemical composition. The final bone cement is produced and influenced by nurses and surgeons in the operating theatre. Control of handling, mixing and delivery procedures is of paramount importance in producing a well cemented implant. The development and application of new cements and cementing techniques has demonstrated increased long term survival rate of cemented implants. This special issue addresses a portion of that effort by publishing state-of-the-art papers in the area of acrylic-based bone cement for orthopaedic applications.

The use of acrylic bone cement in joint replacement surgery is described very well by Whitehouse and Evans in the first paper. The second paper by McEleney et al. focuses on the interaction between the liquid monomer and the polymer powder component of the bone cement during the initial wetting phase of mixing, which could be used to develop improved cement mixing systems. This paper is followed by a research article by Hoey and Taylor on influence of mixing technique on the fatigue performance of bone cement when stress concentrations are present within the microstructure. The influence of mixing technique is also is reported by Hingston et al., whereby they examined the evolution history of residual stresses development within the cement mantle post-polymerisation. The effect of intermittent overloads on the fatigue performance of bone cement is explained clearly by Evans using a novel crossover experimental design approach. Lewis et al. presents an excellent paper characterising the *in vitro* properties of novel bioactive bone cement containing strontia nanoparticles. Kühn presents his highly interesting paper hypothesising the application of gentamicinpalmitate as a potential antimicrobial agent in joint replacement surgery. The final paper by Kühn and Brünke reports the potential of the same novel gentamicinpalmitate coating in the prevention of bacterial adherence and biofilm formation post-surgery.

We hope that this special issue will serve as a reference volume consisting of high quality research papers especially for researchers, biomaterial scientists and biomedical engineers. Peer reviewers whom are experts in the field of biomaterials and bioengineering have refereed the papers presented in this volume. The referees have been extremely helpful and have returned reviews as per schedule. We wish to thank them for their reviews and the authors for submitting such high quality research papers.