

Preface

“Cogito Ergo Sum”

René Descartes 1644

I would like to tell a story that all these years I seldom talked about.

It was on one of those dark sunsets of October 1973 that I found myself wounded in one of those conflicts that unfortunately never ended.

A number of doctors were busy trying to help me and other wounded soldiers under the harsh dangers of the front line. These doctors and following surgeries in hospital helped me to realise how “life was at the edge of a fine line” that separated our existence from death. In reality this happens in many instances throughout human history; on one side, humanity tries to exterminate each other and on the other it tries to save or repair life.

This was my first intimate and personal encounter with the medical field, and I admire those individuals that sacrificed themselves to help. It opened a new thinking in my mind to use my knowledge to help to preserve and improve life. It became a search for solutions to problems within medical science, which opened up new avenues for future endeavours.

After a few months, I found a number of people—at that time—that were the backbones of the “biomedical materials field pioneering research” with their new inventions and ground-breaking research. Dr. Charnley in the UK was one of those orthopaedic surgeons that understood well both biomechanics and materials in addition to his surgical skills. He was an excellent inventive thinker and was experimenting on the total hip joint designs that set the benchmark that we still use today. Professor Weis was working on the first blade-type titanium dental implants in the USA.

On the scientific side of the biomaterials field, Drs. Racquel and John LeGeros were active and initiated the basic chemistry and substitutions of calcium phosphates for bone regeneration and repair. Dr. Larry Hench was a young inventor with unique scientific approach to chemistry and ceramic synthesis to introduce the bioglass and other inventions that motivated generations that followed, and still do. Dr. Samuel Hulbert and his PhD student Dr. Klawitter postulated that porous ceramics can

be used as scaffolds, and produced a list of materials that till today is the golden standard of biocompatible materials. Dr. Aoki pioneered and set the synthesis methods for calcium phosphates that motivated me and others to follow his footsteps and all these giants mentioned in the field. During the late 1970s and the early 1980s, in Asia and specifically in Japan, Drs. Kawahara, Yamamuro, Oonishi and Kokubo and in Europe Klaas de Groot, Ducheyne, Rey and Dacusi and others were experimenting on a range of calcium phosphate bioceramics that further opened new avenues into which many of us built our research.

My motivation and involvement in bioceramics goes back to these researchers and their pioneering research efforts mentioned above. I have admired and have respect for all of the new small steps that many scientists contributed during the years and having motivated us with their work. I was thrilled when Prof. Min Wang proposed that I should edit a book on the “Advances in Calcium Phosphate Biomaterials” for Springer. Immediately, I contacted Prof. Racquel LeGeros to ask her to share with me the pleasure of partially writing and editing this book. Although very busy, she graciously agreed. At the Bioceramics 24 meeting last year in Kyushu, Japan, we prepared the basic structure and the list of authors we aimed to invite to contribute.

We were interested in calcium phosphate-based biomaterials and specifically “apatites” that since the early days have taken a role of passive scaffold for bone regeneration and repair. We were observing that during the last two decades, the concept has changed from passive participation to active involvement to stimulate the body to regenerate and repair the tissue. New-generation calcium phosphate scaffolds are designed to stimulate specific cellular responses in the nanoscale level utilising biogenic additives such as bone morphogenic proteins and stem cells to help release the ionic dissolution products and activate the cells in contact with the biomaterials. With the appropriate microbiological, biochemical and biomechanical stimulation, the cells produce additional growth factors that in turn stimulate generation of growing cells to self-assemble to the required tissues. Taking to account all these factors, we aimed in this book to bring these new concepts, mechanisms and methods by experienced and well-known and young academics, clinicians and researchers to forward their knowledge and expertise on calcium phosphate and related materials and their clinical applications. The general aim was directed not only to cover the fundamentals but also to open new avenues to meet the challenges of the future in research and clinical applications. Both Racquel and I were going to share the responsibility of inviting and co-authoring a few chapters, but it was not meant to be. A few months after sending invitation letters to authors, I received the sad, unexpected and hurting news from Prof. Dacusi that Racquel passed away in France, during her visit, where she usually helped students in their research efforts on calcium phosphates and related materials.

It was a very difficult decision to continue with the book without her guidance and support. However, we felt that this was probably what Racquel would have wanted us to do.

We received 17 chapters, and many others apologised that due to their heavy academic load they could not meet the timeline. This book is therefore their story that covers the advances in calcium phosphate materials from its modern characterisation methods to tissue-biomaterial interactions, from bioglass to biocomposites, from marine structures to drug delivery and from its history to new orthopaedic and maxillofacial applications.

To meet various needs of research, education and clinical applications, each chapter provides clear and fully detailed descriptions, theoretical and experimental issues, discussions and future considerations. This in-depth, practical coverage should also assist the recent graduates and the medical professionals in the calcium phosphate and in general in the biomedical materials field.

Throughout history, science never ceased “advancing”, and I trust that this reference book conveys the intensity of this fast “advancing calcium phosphate” field in an enthusiastic way to generate further research and their medical applications to further help the well-being of humans.

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