



Coordination Chemistry Reviews

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Book review

Metal Ions in Life Sciences, vol. 4: Bio-mineralization. From Nature to Application, A. Sigel, H. Sigel, R.K.O. Sigel (Eds.). John Wiley & Sons, Chichester (2008), ISBN: 978-0-470-03525-2

Some of us remember the first through to volume 44 of the excellent MIBS series which evolved into MILS. The move to the new and broader-minded MILS required affirmative action. With the publication of MILS volume 4, it is time to take stock and to decide whether it has been a case of the re-packaging being more important than the volume contents or whether genuine change in emphasis has indeed occurred. (Full MILS4 chapter contents are available at <http://eu.wiley.com/WileyCDA/Section/id-291193.html#4>.)

Whilst reporting fundamental biochemistries of processes such as bio-mimetic syntheses and repair, MIBS sometimes skirted around the brink by claiming relevance but stopping short of health-benefiting breakthroughs. However, MILS unashamedly applies bio-knowledge to achieve real quality of health spin-offs. Pioneers such as A Veis – *crystals and life and processes of enzymes in bio-mineralization* – and G H Nancollas – *the dynamics, kinetic and thermodynamics, of bio-mineralization* – now illustrate achievements that have been possible with a research lifetime of devotion to benefit delivery. Powered on by energetic catalysis, and by nano-particles, researchers have jockeyed their specialities to realise applied success involving the be-spoke design of new bio-mineralized tissue having specific desirable properties.

Looking backwards, it now seems rather obvious that diverse bio-structures should involve diverse uses for metal ions – to determine sizes, shapes, crystal structures and mechanical properties – effects being either permanent or transient. Long before vertebrates evolved other species used similar metal ion dirigisme to shape the earth's crust. All living organisms are free energy requiring, non-equilibrium, systems that require a constant input of nutrients which are converted into energy and means of storing some of this energy for future use. The essential metal ions involved in this near steady state self-duplicating process often acted through them being part of a biopolymer which directed other biochemistries. "Biology guides chemistry and physics even to the levels of stereo-specificity". This principle has evolved through to our human biochemistry!

Your reviewer's first publication (almost half a century ago!) concerned the dental benefits of added fluoride and its aqueous speciation; fascination with the 5 to 3 to 1 ionic composition structures of apatites has been passed on to (or bored into?) generations of dentistry students! However, this volume stresses that it is not just the increased concentrations of certain key chemical species that are necessary for human tooth or bone repair but also the guidance of collagen-like proteins; this has been the

controlling process throughout the whole evolutionary range from sea-urchins, to marine worm jaws, and on to humans! This volume is worth purchasing if only for its classification of these pivotal bio-mineralization enzymes (Chapter by Weiss and Marin).

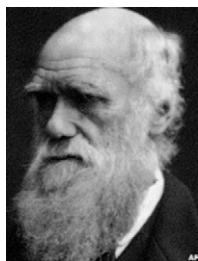
From ions to life-minerals: there is a bio-inspired growth pathway paved by enzymes! From Buchner's discovery of cell-free fermentation and enzymology to modern day biochemistry – there are still many more paths to explore! This volume is an excellent training manual for such expeditions.

"Nature is parsimonious in its use of ingredients and . . . pathways" (Chapter by Wang and Nancollas). "Size is not arbitrary" – as bio-molecules sizes fall below 20–50 nm their strength is maintained and they become insensitive to dissolution! I believe that such self-preservation is a living art and that scientists are privileged to the MILS4 understanding of the detailed molecular biology involved.

As well as precipitating out increased quantities of bio-minerals upon which we depend, it is now possible to challenge the threat of ageing by risk managing encroaching osteoporosis or caries, which may be reversed and staved off through manipulating the scientific principles and using good analytical tests to give appropriate wake-up calls. Generally, our awareness of ageing underestimates the severity of chronic encroachment. Regular checks and targets can offset this. This volume presents a new tool box of techniques; many await commercial development and clinical introduction. Thus, we could well be re-moulded for better life quality (however we define 'better'!).

Clearly, the need for yet another bio-mineralization volume has been made. As well as being a conveniently packaged manner of presenting the latest training facts to newcomers to this interdisciplinary field and to facilitate the composition of research thesis introductory chapters, all references have undergone quality controlled refereeing unreachable by googling and suchlike; secondly, the cross-discipline principles are, more or less, acceptable on all sides of interdisciplinary divides; and thirdly, MILS4 contains the latest up-to-date hypotheses and theories that must surely steer us forward. A collection of non-cross-referenced papers strewn across a range of journals cannot achieve this. In political terms, this book has the bio-delivery potential of a summit conference. Let us hope that other volumes in this new series will achieve likewise!

As we celebrate the 200th anniversary of Charles Darwin and the 'survival of the fittest' it is stimulating to consider our modern definition of "fittest"! The original currency in terms of the courage and strength of hunter-gatherers emerged on to the life scientist's definition spurred on by data-gatherers such as John Snow of causes of death epidemiology data which lead to doubling our life expectancy at birth from 40 to 80 years (1850 to now); what are today's definitions?



Our “fittest” future needs Sigel data-gatherers of MIBS and now MILS to point to a better quality of life through volumes such as bio-mineralization. Life expectancy at birth is now reducing in the developed World through poorer diets, high risk living, obesity, etc. It depends who gets to define “better” or “fittest”! Is it to be our Nanny state? Perhaps, our retail-driven society? Maybe the media? Or MILS interdisciplinary science used for a moral purpose?

Readers would have enjoyed more of the Future directions paragraphs (more details, please, of Nature’s mechanisms

of polymer controlled mineralization, of controlled radical polymerization, and of non-classical particle mediated crystallization).

The publisher team has been changed from MIBS but has some further improvements to target. There is no mention of speciation in the index and page 361 (of my copy) is printed entirely in bold font! In spite of seven blank pages after the index, all chapter abstracts (the most well read part of any book) are printed in micro font size! Pleasingly, this volume is lavishly illustrated with colour diagrams and there is even a cartoon!

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