



BIOLOGICAL MINERALIZATION

Assoc.Prof. Marija Menkinoska

Fundamental Properties of Calcium Phosphate
Precipitation

Nature of the Apatite Precipitate

Structure of bone, dentin and cementum

How does biological mineralization take
place?

Alveolar bone

1. Fundamental Properties of Calcium Phosphate Precipitation

Mineralization represents the deposition of calcium and phosphate salts during the creation of bone and hard

Biological Mineralization

**Nandyala Sooraj Hussain, José D.
Santos**



Biological Mineralization:

Sulfur Joseph Jez, American Society of Agronomy, 2008 Sulfur forms and cycling processes in soil and their relationship to sulfur fertility Jeff J Schoenau and Sukhdev S Malhi Sulfur nutrition of crops in the Indo Gangetic plains of South Asia M P S Khurana U S Sandana and Bijay Singh Soil sulfur cycling temperate agricultural systems J rgen Eriksen History of sulfur deficiency in crops Silvia Haneklaus Elke Bloem and Ewald Schnug Availability of sulfur to crops from soil and other sources Warren A Dick David Kost and Liming Chen Sulfur and cysteine metabolism Rainer Hoefgen and Holger Hesse Sulfur response based on crop source and landscape position Dave Franzen and Cynthia A Grant Sulfur management for soybean production Kiyoko Hitsuda and others Sulfur in a fertilizer program for corn George W Rehm and John G Clapp Sulfur nutrition and wheat quality Hamid A Naeem Sulfur and marketable yield of potato Alexander D Pavlista Sulfur its role in onion production and related alliums George E Boyhan Sulfur and the production of rice in wetland and dryland ecosystems Richard W Bell Evaluation of the relative significance of sulfur and other essential mineral elements in oilseed rape cereals and sugar beet production Ewald Schnug and Silvia Haneklaus Improving the sulfur containing amino acids of soybean to enhance its nutritional value in animal feed Hari B Krishnan Methionine metabolism in plants Rachel Amir and Yael Hacham Plant sulfur compounds and human health Joseph M Jez and Naomi K Fukagawa A future crop biotechnology view of sulfur and selenium Muhammad Sayyar Khan and R diger Hell Mössbauer Spectroscopy Applied to Inorganic Chemistry G.J Long, F. Grandjean, 2013-11-11 In 1988 the Mossbauer effect community completed 30 years of continual contribution to the fields of nuclear physics solid state science and a variety of related disciplines To celebrate this anniversary Professor Gonser of the Universitat des Saarlandes has contributed a chapter to this volume on the history of the effect Although Mossbauer spectroscopy has reached its mature years the chapters in this volume illustrate that it is still a dynamic field of science with applications to topics ranging from permanent magnets to biological mineralization During the discussion of a possible chapter for this volume a potential author asked Do we really need another Mossbauer book The editors responded in the affirmative because they believe that a volume of this type offers several advantages First it provides the author with an opportunity to write a personal view of the subject either with or without extensive pedagogic content Second there is no artificially imposed restriction on length In response to the question How long should my chapter be we have responded that it should be as long as is necessary to clearly present explain and evaluate the topic In this type of book it is not necessary to condense the topic into two four or eight pages as is now so often a requirement for publication in the research literature

Advances in Agronomy, 2009-05-08 *Advances in Agronomy* continues to be recognized as a leading reference and a first rate source for the latest research in agronomy As always the subjects covered are varied and exemplary of the myriad of subject matter dealt with by this long running serial Maintains the highest impact factor among serial publications in agriculture Presents timely reviews on important agronomy issues Enjoys a long standing reputation for excellence in the

field **Problems of Space Biology**, 1973 Biological Mineralization and Demineralization G.H. Nancollas, 1982-05-01 normal and pathological mineralization in vertebrates but also with the interesting problems involved in the formation of intracellular deposits of calcium oxalate in plants Here calcium carbonate and silica may also be involved in the mineralization processes Calcium carbonate is an important component in the formation of mollusc and avian shells The observation that both calcite and aragonite may be formed in biogenic calcium carbonate raises important questions as to what factors control the formation of the final mineral phase There is little doubt that thermodynamically less stable phases may be kinetically stabilized for long periods of time by other molecules present in vivo In normal mineralization calcium salts may initially be deposited both within the cells and extracellularly In the latter case the role of matrix vesicles and the ways in which the matrix components might control mineralization were especially emphasized There is clearly a need for more structural and functional information involving cells matrix components and their associated crystals The development of further techniques involving mutants chromofluors and fixatives for preservation of tissue and the ions present in vivo was recommended In dealing with abnormal and pathological mineralization the Workshop concentrated on urolithiasis gout and pseudo gout and the formation of dental caries Discussions based on the influence of media of low pH on mineral surfaces highlighted some of the factors of importance in controlling crystal dissolution **NASA Technical Translation**, 1973

Mechanisms and Phylogeny of Mineralization in Biological Systems Shoichi Suga, Hiroshi Nakahara, 2012-12-06 Various kinds of mineralization have been found in many biological systems Investigations made at a microscopical level using various sophisticated analytical methods and using principles developed in different fields have clarified their mechanisms very much Sometimes very similar phenomena have been found in the mineralized tissues of completely different biological systems Compilation and comparative investigations of such findings obtained from the many specimens systematically collected contribute a great deal to an understanding of the crucial mechanisms and significance of biomineralization which originated in very primitive organisms and remain in advanced ones Previously the functional significance of mineralized tissues was considered mainly from an anatomical point of view based upon their morphological and structural features However the recent advance of investigations has made it possible to interpret the functional significance of biomineralization not only from local and mechanical points of view but also from a systemic and phylogenetic point of view It is also well known that biomineralization has contributed in various ways to geological and oceanographical conditions of the environment in which the organisms were living During this process the mechanisms of biomineralization may have evolved to maintain harmony between organisms and their environments *Biomaterials for Bone, Regenerative Medicine* Nandyala Sooraj Hussain, José D. Santos, 2010-03-01 Volume is indexed by Thomson Reuters BCI WoS The aim of *Biomaterials for Bone Regenerative Medicine* is to review extensively the latest developments in Biomaterials and their application to bone regeneration in vivo Indeed research on biomaterials and their novel applications is essential because of

the health issues related to the aging population A wide range of worldwide investigations is being undertaken by eminent scholars in order to develop further innovative materials for next generation applications In future it is expected that a tissue engineering approach associating novel biomaterials with stem cells will be available for all types of bone defect

Modified Inorganic Surfaces as a Model for Hydroxyapatite Growth Lilyana Pramatarova, Emilia

Pecheva, 2006-03-03 The process by which organisms in Nature create minerals is known as biomineralization a process that involves complex interactions between inorganic ions crystals and organic molecules resulting in a controlled nucleation and growth of minerals from aqueous solutions During the last few decades biomineralization has been intensively studied due to its involvement in a wide range of biological events starting with the formation of bones teeth cartilage shells coral so called physiological mineralization and encompassing pathological mineralization i e the formation of kidney stones dental calculi osteoporosis arteriosclerosis osteogenesis imperfecta etc During the same period biomineralization has become a hot topic for world wide research throughout the world due to the growing expectations of a good quality and duration of life by the ever increasing population of the aged Young people in particular also make increasing demands on the quality and the appearance of the existing implants available on the market The general goals of research and manufacture are now to create and improve implants for various applications in the human body as well as to prevent diseases leading to the formation of minerals such as hydroxyapatite implicated for example in osteogenesis kidney stones dental calculi arteriosclerosis all problems which mainly affect women The results presented in this book will make a significant contribution to the application of the modified surfaces of widely studied materials as a model system for hydroxyapatite coating to the cultivation of cells on surfaces as well as to the growth of hydroxyapatite by applying new technologies such as laser liquid solid interaction that facilitate nucleation and growth In this way materials and layers having possible applications as implants biosensors etc can be obtained The in vitro system described here is universal and can be applied not only to the production of hydroxyapatite coatings for implants but also to investigating the basic mechanisms of mineral formation diseases and thus identify new directions for prophylaxis This will then make a strong contribution to improving the quality and duration of life of the population

The Fertilizer Encyclopedia Vasant Gowariker, V. N.

Krishnamurthy, Sudha Gowariker, Manik Dhanorkar, Kalyani Paranjape, 2009-04-08 Fertilizers are key for meeting the world s demands for food fiber and fuel Featuring nearly 4 500 terms of interest to all scientists and researchers dealing with fertilizers The Fertilizer Encyclopedia compiles a wealth of information on the chemical composition of fertilizers and includes information on everything from manufacturing and applications to economical and environmental considerations It covers behavior in soil chemical and physical characteristics physiological role in plant growth and soil fertility and more This is the definitive up to date reference on fertilizers This book is not available for purchase from Wiley in the country of India Customers in India should visit Vasudha Research Publications Pvt Ltd at www.fertilizerencyclopedia.com **The**

Chemistry and Biology of Mineralized Connective Tissues Arthur Veis,1981 **Biological Mineralization** Isadore Zipkin,1973 **Biological Mineralization and Demineralization** G.H. Nancollas,2012-12-06 normal and pathological mineralization in vertebrates but also with the interesting problems involved in the formation of intracellular deposits of calcium oxalate in plants Here calcium carbonate and silica may also be involved in the mineralization processes Calcium carbonate is an important component in the formation of mollusc and avian shells The observation that both calcite and aragonite may be formed in biogenic calcium carbonate raises important questions as to what factors control the formation of the final mineral phase There is little doubt that thermodynamically less stable phases may be kinetically stabilized for long periods of time by other molecules present in vivo In normal mineralization calcium salts may initially be deposited both within the cells and extracellularly In the latter case the role of matrix vesicles and the ways in which the matrix components might control mineralization were especially emphasized There is clearly a need for more structural and functional information involving cells matrix components and their associated crystals The development of further techniques involving mutants chromofluors and fixatives for preservation of tissue and the ions present in vivo was recommended In dealing with abnormal and pathological mineralization the Workshop concentrated on urolithiasis gout and pseudo gout and the formation of dental caries Discussions based on the influence of media of low pH on mineral surfaces highlighted some of the factors of importance in controlling crystal dissolution *Bioceramics 13* S. Giannini,A. Moroni,2000-09-06 Proceedings of the 13th Int Symp on Ceramics in Medicine Bologna Italy 22-26 Nov 2000 **Biological and Bioinspired Materials and Devices** Materials Research Society. Meeting,2004 The special interest afforded biological and bioinspired materials and devices lies in the fact that many biological materials as diverse as bone and teeth and spider silk have highly refined and sophisticated platforms of structure that are well organized at hierarchical levels spanning nanoscale to microscale measures There is absolutely strict and precise control of materials synthesis exerted by these natural systems and vigorous study and advancement in the fields of biomineralization molecular biology and DNA technology for instance have brought increasing understanding of such control in ever expanding fashion This knowledge has been quickly transferred into the design and development of synthetic materials that mimic their biological counterparts In this context an explosion in research in the past few years has centered on the identification and synthesis of 1 unique ceramics or composites for biomaterials magnetic and optical use 2 self assembled biopolymeric systems for biomaterials and biosensor application and 3 colloidal and amphiphilic systems for relevance in biomedicine nanotechnology and biosensor fabrication Therefore new nanocrystalline composites nanofibers biosteel fibers novel biosensors distinctive drug delivery systems exceptional tissue engineering scaffolds exclusive molecular imprinting matrices and innovative photonic crystals are suddenly available Given this backdrop the papers in this volume involve biology medicine engineering physics chemistry and materials science Topics include biomineralization and the structure and mechanical magnetic and optical properties of biominerals implant materials

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