
Preface

Osteocardiology is an exciting and new field of science, which will become the cornerstone for defining the timing and treatment of cardiovascular calcification in the future. In 2017, with the advent of large cohort databases, and experimental mechanistic studies, research has elucidated evidence confirming that traditional cardiovascular risk factors are responsible for the development of atherosclerotic calcification. Over the past 50 years, experimental studies have identified the critical elements of atherosclerosis, including foam cell formation, vascular smooth muscle cell proliferation and extracellular matrix synthesis, which over time forms bone in the heart. The Nobel Prize in Physiology or Medicine 1998 was awarded jointly to Drs. Robert F. Furchgott, Louis J. Ignarro and Ferid Murad, “for their discoveries concerning nitric oxide as a signaling molecule in the cardiovascular system”. This discovery helped to understand the role of the endothelium in normal vasodilatation for maintenance of normal vascular biology, and the effect of oxidative stress on the down-regulation of endothelial nitric oxide synthase in the development of disease.

In the mid 1990s Dr. Linda Demer pioneered the concept of bone biology in the vascular calcification and developed sophisticated models of oxidative stress and bone analysis. Dr. Catherine Otto and Dr. Kevin O’Brien, from University of Washington, began early studies in identifying the presence of lipoproteins in the calcifying valves. Dr. Emile Mohler, at the same time, identified bone formation in the calcifying aortic valve. In vitro, Dr. Christopher Johnson developed cell culture models of the aortic valve, performing pioneering work in the field of fibronectin synthesis. Dr. Thomas Spelsberg’s collaboration and friendship, was instrumental in the merging of bone biology and valve biology. Dr. Philippe Sucosky, in bioengineering, has become the leader in the field of valve hemodynamics, in addition to the seminal contributions from Dr. Simmons in endothelial gene expression, Dr. Bob Weiss studying aging mouse models of CAVD, Dr. Pibarot in echo hemodynamics of valvular heart disease, Dr. Aikawa, the first to demonstrate a renal failure model of aortic valve disease with bone loss, Dr. Genest studies in patients with Familial Hypercholesterolemia has defined cardiovascular calcification phenotype, and Dr. Berger-Klein, defining the role of biomarkers in CAVD. Finally, the bench to bedside seminal study, RAAVE performed by Dr. Luis Moura from Porto, Portugal will set the stage for future clinical trials in the field of cardiovascular calcification.

MESA, Multi Ethnic subclinical atherosclerosis cohort, has developed a powerful database of CT imaging of a population which does not have clinical overt cardiovascular disease, making this tool of great importance in advancing our knowledge of the timing of calcification and the risk factors associated with this phenotype. Many of the several discoveries from this database will be outlined in this textbook of bone formation in the heart.

My 30 years of experience in the field of valve biology, echocardiography, clinical trials, and a MESA researcher, this overview of bone formation in the heart will hopefully, become the cornerstone to educate medical students, residents, fellows, graduate students, physician scientists and scientists, for future research and ongoing development in medical therapies to slow or halt the progression of bone formation in the heart, i.e. osteocardiology.

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Osteocardiology

Cardiac Bone Formation

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