MAR15-2014-020457

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Arterial mechanobiology: The interrelation of elastin, collagen, and GAGs[1]

KATHERINE ZHANG, Boston University

The complex network structure of elastin and collagen extracellular matrix (ECM) forms the primary load-bearing component in the arterial wall. Pathogenesis of many cardiovascular diseases is associated with loss of organization and function of the ECM. However the interrelation of the function of collagen and elastin and the effect of ECM structural changes on vascular mechanics are not well understood. This talk will focus on our recent study on the interrelations of ECM constituents and how they contribute to the mechanical function of the arterial wall. Our recent study coupling mechanical loading and multi-photon imaging demonstrates an interesting sequential engagement of elastin and collagen fibers in response to mechanical loading. Our study also suggests that the elastin fibers are under tension and impart an intrinsic compressive stress on collagen. Such delicate interrelation between elastin and collagen is essential for an artery to function normally. Studies of the structural components and mechanics of arterial ECM generally focus on elastin and collagen while glycosaminoglycans (GAGs) are often neglected, most likely because of the relatively low content in arterial tissue. Our study shows that GAGs play a role in engaging the elastin and collagen fibers in the arterial wall and thus indirectly affect the biomechanical function of arteries. Together these results provide a more comprehensive understanding of the mechanobiology of arteries with the goal of incorporating such information in understanding disease progressions and structurally based constitutive models.

[1]The author would like to acknowledge the funding support from NIH R01HL098028, NSF CMMI 1100791 and CMMI 0954825.