Crucial Role of Telomerase Activity in Mitigation of Chemotherapeutic/Cardiovascular Disease Induced Reactive Oxygen Species Mediated Oxidative Stress and Reconstitution of Microvascular (Endothelial) Function

Quryshi, Nabeel

Coronary Artery Disease is often characterized as the world's deadliest disease, leading to the mortality of 7.4 million individuals in 2012. In addition, the adverse effects of Chemotherapy pose grave threats towards cardiovascular integrity by augmenting vascular oxidative stress. Telomerase, often regarded as an anti-aging related enzyme, is a nuclear derived regulator of telomere elongation. Videomicroscopy with isolated microvessels shows that inhibition of telomerase changes the mediator of dilation from NO to H202 in healthy patients, while upregulation of telomerase recapitulates a healthy vascular phenotype in subjects with either of the aforementioned detriments. After demonstrating the novel ability of telomerase to localize to the mitochondria under oxidative stress, a novel set of subcellular TERT decoy peptides were created to efficiently modulate the subcellular localization of TERT and consequently reduce mtROS, positively modulate oxidative stress related gene expression and restore healthy vessel formation. As coronary artery disease is not the only detriment characterized by oxidative stress, mitochondrial telomerase has the potential to serve as a novel therapeutic treatment amidst a wide range of other diseases such as various neurological/psychological disorders as well as Diabetes. Subsequently, a computational mechanistic mathematical model of the mitochondria was created, incorporating many individual mitochondrial enzymatic components while utilizing the MATLAB computing environment. Finally, a computational script was developed which more efficiently screens and analyzes genomic data in order to expedite genomic research. Through this multidisciplinary study, the roles of telomerase and our understanding of the mitochondria continue to grow.

Awards Won:

First Award of $5,000