Developing Novel Gene Candidates (MEF2A, LTA, LGALS2, ALOX5AP, and PDE4D), through an Adaptive Genetic Algorithm, Support Vector Cluster, and Dynamic Bayesian Networks, to Analyze in a Learning Classifier System for a Highly Propitious CRISPR Therapy for Ischemic Heart Disease

Warman, Roshan

The purpose of the research conducted was to optimize treatments for the world’s deadliest disease, Ischemic Heart Disease, by using the most novel tools available: CRISPR and Machine Learning. IHD is the most common medical ailment and it has become increasingly accepted that it is caused by multiple genetic and environmental factors and interactions among these factors. The understanding of the CRISPR system and its Cas9 (crRNA, tracrRNA) and Cpf1 (crRNA, sgRNA) endonucleases has been a defining moment of scientific advancement. Precise gene modification's medical treatments range from HIV to cancer to even a genetic based cold. Another pioneering breakthrough has been the understanding of machine learning. Applied in this research were four different types of ML schemes: In Phases 1 and 2, an SVM was used to gather genes and classify them using the kernel method. This involved the use of a Stanford Parser and databases (NCBI's GeneRif and NIH's Metamap). In Phase 3, Bayesian Networks were able to calculate the probability of an effector gene contributing to IHD. The top genes were put through an adaptive genetic metaheuristic and finally, in Phase 4, novel genes were tested in a highly accurate mathematical model of the biological microenvironment developed in MATLAB (using an LCS). This project introduces a novel, highly propitious Ischemic Heart Disease treatment modality. The development of a highly accurate cell dynamics model entailed accounting for the various factors of cell quiescence, cell heterogeneity, gene resistance, and immune response. For the observed data, the novel CRISPR therapy were able to eliminate or at the very least normalize faulty gene expression, and further displayed a transgenerational absence of any Ischemic Heart Disease genesis.

Awards Won: