A Novel Approach to Early Directional Diagnosis of Prescription Opioid Addiction

Rao, Gitanjali (School: STEM School Highlands Ranch)

Prescription opioid addiction is a national health crisis. Today, patients or physicians do not have a way of diagnosing if a painkiller given for relief is causing addiction. Current approaches of diagnosis are based on self-assessment, or psychological evaluations, which are often too late. Using genomics, the proposed solution uses the measurement of variations in the Mu Opioid Receptor protein produced by the OPRM1 human gene. The research and experimentation included behavior of OPRM1 gene in response to exogenous opioids such as prescription drugs like oxycodone and fentanyl. In addition, the increase in protein levels due to agonist were mapped to a user-friendly scale that gives a metric for physicians to take action. The research output also included design, fabrication and testing of a portable prototype tool to directionally indicate the onset of opioid addiction in patients. My work involved simulating the behavior of human genes addicted to opioids in a lab environment using actual human OPRM1 gene on a Saccharomyces Cerevisiae host. The methods used included yeast strain preparation with CRISPR/cas9 expressed with OPRM1 and standard protein detection techniques such as ELISA and Western Blot methods. The portable solution to substitute the colorimetry process of protein detection used the image processing algorithms, connected to a mobile device over Bluetooth. The results were able to conclusively support that OPRM1 protein levels can be measured in presence of an agonist, and they are proportional to the levels of opioids in the system. Future work includes testing using mammalian antibody and assay along with re-calibrating the portable device. This incremental solution that focuses on diagnosis rather than treatment can save lives.

Awards Won: