# Multi-Drug Resistance in Advanced-Stage Breast Cancer: A Data Science Approach Analyzing Drug Transporter Gene Amplification and Patient Survival

Shenoy, Nidhi (School: Lakeside High School)

Several breast cancer patients develop resistance to multiple chemotherapeutic agents. ATP-binding cassette (ABC) family of drug transporters have been hypothesized to be potentially involved in developing multi-drug resistance (MDR) through the effluxion of the drugs out of the cells. As of today, there are no clinical data on whether these drug transporters are associated with the development of MDR, aggressiveness, and metastatic ability of breast cancer cells. I performed a genome atlas analysis of breast cancer patient biopsies from the cBioportal database. The patient data were assessed for any alterations in the ABC transporters family—ABCG2, ABCG1, ABCC4, ABCA2, ABCA3, ABCC2, ABCC3, ABCC6, ABCC7, and ABCC9. It is hypothesized that the mutation-induced activation and amplification of one or more of the ABC family of transporter genes will correlate with the MDR, aggressiveness, and metastatic potential of breast cancer. In our overall analysis of 11,632 samples from 25 clinical trials, gene alterations ranging from 1% of cases in ABCG2, 7% of cases in ABCC6 and ABCA3, and 9% of cases in ABCC3 were found. A higher number of gene amplification cases of ABC transporters were observed in highly aggressive, metastatic breast cancer patients compared to the low-grade breast cancer population. The amplification of ABCC3, ABCC6, ABCA2, and ABCA3 was observed to be the highest among the 10 ABC transporter genes analyzed. This study indicates gene amplification of ABCC3, ABCC6, ABCA2, and ABCA3 drug transporters in a subset of breast cancer patients is likely linked to the development of MDR and metastatic ability. Further studies will be necessary to establish a causal link between the identified ABC transporters and the development of MDR in breast cancer patients.

**Awards Won:**