



Seeds4Hope

A program of the Windsor Essex County Cancer Centre Foundation

2014 SEEDS4HOPE GRANT RECIPIENT

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“Detecting Driver Genes and Network Biomarkers of Breast Cancer Subtypes”



SUMMARY OF RESEARCH PROJECT

Breast cancer (BC) is a complex disease consisting of five (5) major subtypes, each arising from a distinct molecular mechanism and having a distinct clinical progression. Recent studies have revealed extensive diversity both between and within BC tumors, and that most tumors present unique characteristics. This heterogeneity poses significant challenges to BC diagnosis and treatment, with many BC patients undergoing over treatment. The development of BC is caused by mutations of a small number of genes, called driver genes, whose changes deregulate many biological processes, and therefore leading to initiation and progression of BC as well as resistance to treatment. An important task is to discover the drivers in order to understand the disease, characterize its subtypes, and develop better therapies. Finding the drivers is however a challenging problem due to the heterogeneity of BC tumors. In addition, recent studies have categorized breast cancer into ten (10) subtypes, suggesting that biomarkers identified for characterizing these ten subtypes (rather than the usual five subtypes) would yield a better understanding, diagnostic, and treatment of breast cancer.

Networks biomarkers (NBs) are disease-related sub-networks of interacting genes, proteins or cellular pathways, corresponding to genes which “work in concert” to perform functions associated with a tumor state. NBs are more reliable than single-gene (protein or metabolite) biomarkers since they take into account the functional dependency or interaction between genes, proteins or pathways. Alterations of the NBs can be monitored and evaluated at different stages and time points during the development of the disease. NBs are expected to correlate with clinical outcomes, patient states, therapies, disease progression, and other measurements, and provide new strategies for early cancer detection and cancer care.

The focus of this research is to 1) devise computational methods that will assist in the accurate identification of the driver genes of the BC subtypes 2) identify the network biomarkers of each subtype, and 3) build better classifiers to separate the subtypes. A network biomarker (NB) is a disease-related network of genes.

HOW THIS RESEARCH HELPS ADVANCE QUALITY CANCER CARE IN OUR COMMUNITY

In the Windsor-Essex County (WEC), breast cancer is: (1) among the top three cancers diagnosed; (2) the most common cancer among females; and, (3) the second most common cancer-specific cause of death among females. There has been lot of research on the characterization of breast cancer based on five subtypes and very little is known on the new classification into ten subtypes. Network biomarkers identified for these ten subtypes are expected to provide better diagnosis (including early detection) of breast cancer as well as better strategies for cancer care and early intervention at different stages of the disease. Reliable networks biomarkers also serve as potential drug targets in the future, and thus, provide new therapeutic strategies for breast cancer.