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Modeling the Intricate Relationship Between Mirna Dysregulation and Breast Cancer Development

Authors : Sajed Sarabandi, Mostafa Rostampour Vajari

Abstract : Breast cancer is the most frequent form of cancer among women and the fifth-leading cause of cancer-related deaths. A common feature of cancer cells is their ability to survive and evade apoptosis. Understanding the mechanisms of these pathways and their regulatory factors can lead to the development of effective treatment strategies. In this study, we aim to model the effect of key miRNAs, which are significant regulatory factors in breast cancer. We designed a Petri net focusing on two crucial pathways: proliferation and apoptosis, and identified the role of miRNAs in these pathways. Our analysis indicates that the upregulation of miRNAs 99a and 372 can effectively increase apoptosis and decrease proliferation. Moreover, we demonstrate that miRNA-600, previously reported as a potential candidate for treatment, may not be a suitable target due to its dual activity in proliferation. Therefore, further research is required to investigate the potential of this miRNA in cancer treatment. Our model shows that a combination of miRNA upregulation and knockdown can efficiently influence key genes such as MDM2 and PTEN, leading to the activation of apoptosis in cancer cells. Ultimately, our model successfully simulates the connection between regulatory miRNAs and key genes in breast cancer.

Keywords : breast cancer, microRNAs, bio-modeling, Petri net
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