**Using Graph Statistics to Investigate the Properties of Six Gene Regulatory Networks that Control the Cold Shock Response in Saccharomyces cerevisiae**

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A gene regulatory network (GRN) is a set of transcription factors which regulates the level of expression of genes encoding other transcription factors. The dynamics of a GRN show how gene expression in the network changes over time. Microarray data were obtained from the wild type strain and five transcription factor deletion strains (Δcin5, Δgln3, Δhap4, Δhmo1, Δzap1) before cold shock at 30°C and after 15, 30, and 60 minutes of cold shock at 13°C. A modified ANOVA showed that for all networks a large number of genes had a log2 fold change significantly different than zero at any of the time points. These genes were submitted to the YEASTRACT database to determine which transcription factors regulated them. Data from each strain were used to generate candidate GRN’s of between 14-17 nodes and 25-36 edges, depending on the specific network. The open source software Gephi was used to analyze the graph properties of each network in terms of the in and out degrees and centrality measures, focusing on betweenness centrality, eccentricity and closeness centrality. These centrality measures indicate which nodes are most easily accessed in each network, how central a node is in a network, and which nodes most frequently appear in the shortest paths of a network. From this analysis we have gained insight into role of different genes in the gene regulatory network that controls the cold shock response in yeast, such as the central roles of the genes MSN2 and YHP1 across all networks.

Keywords: *Saccharomyces cerevisiae*, Hap4, gene regulatory network, dynamical systems modeling

Required word count: 250 Actual Word Count: 247