

Network Medicine: From Cellular Networks to the Human Diseaseome

The ultimate goal of understanding sub-cellular networks is to gain insights into the normal cellular functions, and understand the microscopic nature of perturbations that could lead to human diseases. A network of disorders and disease genes linked by known disorder-gene associations offers a platform to explore in a single graph-theoretic framework all known phenotype and disease gene associations, indicating the common genetic origin of many diseases. We find that the vast majority of disease genes are nonessential and show no tendency to encode hub proteins, and their expression pattern indicates that they are localized in the functional periphery of the network. We also study the evolution of patient illness using a network summarizing the disease associations extracted from 32 million Medicare claims, demonstrating that the cellular level links between disease causing proteins are amplified in the population as comorbidity patterns.