Motifs and Modules in Cellular Signal Processing: Applications to Microbial Stress Response Pathways

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Abstract

Bacterial and animal cells are dynamic machines whose internal chemical networks perform hundreds of complex control and signal processing tasks to govern cellular development over time and in response to deterministic and stochastic signals from the environment. A central challenge in post-genomic biology is to discover the complete physical nature of these networks and to determine if there are principles of control and signal processing by which these cell operate and evolve. If such principles exist then they are handles by which cellular engineers can determine the best placement of external signals (such as pharmaceuticals) to cause a cell to move from an undesired state to a desired state. Here, initial attempts at determining the principles of control, the possible modular structure and the nature of signal flow in cellular networks are briefly introduced. We use examples from bacterial stress response pathways and yeast deletion viability studies to illustrate the principles and approaches.

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