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Chaotic Gene Regulatory Networks Can Be Robust Against Mutations and Noise[1] VOLKAN SEVIM, PER ARNE RIKVOLD, Florida State University — Robustness to mutations and noise has been shown to evolve through stabilizing selection for optimal phenotypes in model gene regulatory networks. The ability to evolve robust mutants is known to depend on the network architecture. How do the state-space structures of networks with high and low robustness differ? Here we present large-scale computer simulations of a Random Threshold Network model of gene regulatory networks undergoing biological evolution. We show using damage propagation analysis and an extensive statistical analysis of state spaces of these model gene networks that the change in their dynamical properties due to stabilizing selection is very small. Therefore, conventional measures of stability do not provide much information about robustness in model gene regulatory networks. Interestingly, the networks that are most robust to both mutations and noise are highly chaotic. Chaotic networks are able to produce large attractor basins, which can be useful for maintaining a stable gene-expression pattern.
[1] V. Sevim and P. A. Rikvold (2007), e-print arXiv:0708.2244.
[2] V. Sevim and P. A. Rikvold (2007), e-print arXiv:0711.1522.

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