Genetic Robustness: Promiscuity, plasticity and modular rewiring of interaction networks

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Genetic robustness is the ability of organisms to withstand and resist effects of mutation in their genomes? We addressed the extent of mutational robustness by genome wide dosage suppressor analysis of conditional lethal gene mutations in cell division cycle and RNA synthesis related genes, revealing a complex network of suppressor interaction. We have found several distinct mechanisms of suppression, including inter and intra module compensatory protein-protein interaction, bypass of essential biological processes by alternate functions, and, relatively less frequently, orthologous genes that assume possibly ancestral functions. We address whether the suppressors and their suppressed mutations tend to co-occur within identifiable structural and functional modules, and whether suppression can occur within or across functional modules. The existence of a dense dosage suppressor network implies the presence of numerous functionally diverse mechanisms in eukaryotes for circumventing lethal perturbations in their genomes, which also provide a glimpse of their evolutionary histories.