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Turbulent genomes: quantification of gene acquisition, loss and displacement in prokaryotes

Genomes of bacteria and archaea exist in incessant flux, constantly acquiring and losing genes. We performed a comprehensive analysis of 36 groups of closely related microbial genomes to quantify relative contribution of different genome dynamic events. The results suggest an extremely high rate of both gene loss and acquisition, in large part, coupled through the phenomenon known as xenologous gene displacement whereby a recently acquired homologous gene rapidly replaces the vertically inherited copy. Acquisition of homologous genes, not intragenomic duplication, also dominates expansions of multi-gene families. The relative rates of acquisition and loss are not precisely balanced, indicating that the prevailing mode of evolution in bacteria and archaea is genome contraction, probably punctuated by bursts of gene gain.