

Abstract

Our cells continuously experience several kinds of non-genetic errors, which need to be mitigated in order to keep the robustness of the cellular system. Here we studied two types of error. 1) First, even if all cells are precisely in same conditions, there is stochastic variation in gene expression among the cells, which is termed as intrinsic noise. If the expression of an essential gene is altered to a significant level, then it may be lethal for the cell. Thus for the stable functioning of the cell it is necessary to keep the expression noise minimum for essential genes. How exactly cells achieve this is not clear. We hypothesize that physical attachment of genes to the sub-nuclear compartments like transcription factories might reduce its mobility and consequently the noise in its transcription. 2) Second, altered expression at certain loci could disproportionate the required concentrations of functionally related gene-products, which are generally positioned in the genomic neighbourhood. This error can be mitigated by simultaneous alteration in the expression of neighbouring genes, termed as transcriptional ripple. The underlying mechanism is not understood. We propose that physical interactions among neighbouring genes influence their transcriptional states. To simulate the phenomenon, we made perturbation transmission model inspired by communicating vessels principle, which essentially captures the ripple-effect and can be used study the phenomenon and its functional consequences at genome scale.