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Information Propagation in Developmental Enhancers SIDDHARTHA JENA, MICHAEL LEVINE, Princeton University — Rather than encoding information about protein sequence, certain lengths of noncoding DNA, called enhancers, interact with protein machinery such as transcription factors to precisely regulate gene expression. Enhancers have been studied extensively in the fruit fly *Drosophila melanogaster*, where they regulate the expression of developmental genes that establish the blueprint of the adult fly. It has been suggested that enhancer sequences possess a specific but unknown syntax with regards to the placement and strength of transcription factor binding sites. Moreover, studies in divergent fly species have shown that compensatory evolution allows for maintenance of enhancer functionality despite considerable variation in primary DNA sequence. Here, the possible role of enhancers as signal processing modules is studied as a way of explaining these two findings. We first demonstrate how this framework can be used to explain the fine-tuned spatiotemporal dynamics of gene expression. We then explore the evolutionary pressure on enhancer sequences and the resulting emergence of enhancers that are linked by compensatory mutations. This study provides a possible mechanism for the function of multiple enhancers linked to a single gene.

Siddhartha Jena
Princeton Univ

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