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Origination of Chimeric Genes through DNA-Level Recombination

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Abstract

Comparative genomics is rapidly bringing to light the manifold differences that exist within and between species on the molecular level. Of fundamental interest are the absolute and relative amounts of the genome dedicated to protein coding regions. Results thus far have shown surprising variation on both the polymorphism and divergence levels. As a result, there has been an increase in efforts aimed to characterize the underlying genetic mechanisms and evolutionary forces that continue to alter genomic architecture. In this review we discuss the formation of chimeric genes generated at the DNA level. While the formation of chimeric genes has been shown to be an important way in which coding regions of the genome evolve, many of the detailed studies have been limited to chimeric genes formed through retroposition events (through an RNA intermediate step). Here we provide a short review of the reported mechanisms that have been identified for chimeric gene formations, excluding retroposition-related cases, and discuss several of the evolutionary analyses carried out on them. We emphasize the utility chimeric genes provide for the study of novel function. We also emphasize the importance of studying chimeric genes that are evolutionarily young.

Fundamental to an understanding of biological diversity are questions pertaining to the acquisition of new functions. As a result, the origin of evolutionary novelty has long captured the imagination of evolutionary biologists and naturalists. On the molecular scale, chimeric genes – by which we are referring to gene structures (both coding and noncoding) that have been derived from multiple parental loci – provide a useful system for studying the origin of new functions. The first reason for this is that chimeric genes are unlikely to have