Formation and evolution of primate-specific gene functions

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Motivation

Orthologous genes that maintain a single copy status in a broad range of species may indicate a selection against gene duplication. If this is the case, then duplicates of such genes which do survive may have escaped the dosage control by rapid and sizable changes in their function.

Methods

To test this hypothesis and to develop a strategy for the identification of novel gene functions, we have analyzed 22 primate-specific intrachromosomal duplications of genes with a single copy ortholog in all other completely sequenced metazoans. When comparing this set to genes not exposed to the single copy status constraint, we observed a higher tendency of the formers to modify their gene structure, often through complex genomic rearrangements.

Results

The analysis of the most dramatic of these duplications, affecting about 10% of human Chromosome 2, enabled a detailed reconstruction of the events leading to the appearance of a novel gene family. The 8 members of this family originated from the highly conserved nucleoporin RanBP2 by several genetic rearrangements such as segmental duplications, inversions, translocations, exon loss and domain accretion. We have experimentally verified that at least one of the newly formed proteins has a cellular localization different from RanBP2 and we show that positive selection did act on specific domains during evolution.

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