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## Modern Genomes with Retro-Look: Retrotransposed Elements, Retroposition and the Origin of New Genes

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### Abstract

A fascinating evolutionary facet of retroposition is its ability to generate a dynamic reservoir of sequences for the formation of new genes within genomes. Retroelement genes, such as *gag* from retrotransposons or envelope genes from endogenous retroviruses, have been repeatedly exapted and domesticated during evolution. Such genes fulfill now useful novel functions in diverse aspects of host biology, for example placenta formation in mammals. New protein-coding genes can also be generated through the reverse transcription of mRNA from 'classical' genes by the enzymatic machinery of autonomous retroelements. Many of these retrogenes, which generally show a modified expression pattern compared to their molecular progenitor, have a testis-biased expression and a potential role in spermatogenesis in different animals. New non-protein-coding RNA genes have also been repeatedly generated through retroposition during evolution. A striking evolutionary parallel has been observed between two such RNA genes, the rodent BC1 and the primate BC200 genes. Although both genes are derived from different types of sequences (tRNA and Alu short interspersed element, respectively), they are both expressed almost specifically in neurons, transported into the dendrites and included in ribonucleoprotein complexes containing the poly(A)-binding protein PABP. Both BC1 and BC200 RNA are able to inhibit translation *in vitro* and are progenitors of new families of short interspersed elements. These genes, which might play a role in animal behavior, provide an astonishing example of evolutionary convergence in two distinct mammalian lineages, which is also observed for placenta genes derived from endogenous retroviruses. Finally, there are indications that genes for small nucleolar RNAs (snoRNAs) and possibly microRNAs (miRNAs) can also be duplicated via retroposition. Taken together, these observations definitely demonstrate the major role of retroposition as mediator of genomic plasticity and contributor to gene novelties. Therefore, the 'retro-look' of genomes is in fact indicative of their modernity.