

DEGENERATION OF OLFACTORY RECEPTOR GENE REPERTORIES IN PRIMATES: NO DIRECT LINK TO FULL TRICHROMATIC VISION

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Odor molecules in the environment are recognized by olfactory receptors (ORs). We compared the repertoires of OR genes of five primate species including New World Monkeys (NWMs), Old World Monkeys (OWMs), and hominoids for which high-coverage genome sequences are available, together with two prosimians and tree shrews with low-coverage genomes. It is generally thought that primates are vision-oriented and dependent weakly on olfaction. Previous studies suggested that OWMs and hominoids lost many functional OR genes after the divergence from NWMs due to the acquisition of well-developed trichromatic vision. However, our results showed no significant differences in the number of functional OR genes between NWMs and OWMs/hominoids. Two independent analyses, identification of orthologous genes among the five primates and estimation of the numbers of ancestral genes by the reconciled tree method, did not support a sudden loss of OR genes at the branch of the OWMs/hominoids ancestor, but suggested a gradual loss in every lineage. Moreover, we found that humans retain larger numbers of ancestral OR genes that were in the common ancestor of NWMs/OWMs/hominoids than orangutans and macaques, and that the OR gene repertoire in humans is more similar to that of marmosets than those of orangutans and macaques. These results suggest that the degeneration of OR genes in primates cannot simply be explained by the acquisition of trichromatic vision, and our sense of smell may not be inferior to other primate species.

Keywords: smell sense, color vision, gene loss, multigene family