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Environmental impact of olfactory senses

Comparing genomes of different organisms can give insight into how evolution has shaped sense of smell across the animal kingdom. Humans have over 3,000 olfactory genes in their genome, yet over 300 of these genes have evolved to be nonfunctional (Shubin 2009). Because humans have traded an enhanced sense of smell for a better sense of sight, it makes sense that so many human olfactory genes would be silenced. In contrast, many species of nocturnal birds have developed larger olfactory bulbs, a larger number of olfactory receptor genes, and a better sense of smell compared to their more visually inclined diurnal counterparts (Healy, 1990) (Steiger et al., 2009). A higher number of olfactory receptors give nocturnal animals the ability to sense more diverse smells in the nighttime environment, enabling them to better detect food in the absence of daylight. Studying specific sensory trade-offs between sight and smell can therefore give clues to what is important about an animal’s behavior.

Different ecological niches also lend themselves to different forms of sensory selection. Fossorial animals tend to have a decrease in both visual and olfactory capabilities. Instead, a stronger sense of touch could be enhanced in burrowing animals like the blind mole rat (Barton et al., 1995). In the more extreme environment of the hadal oceanic zone, the Mariana snail fish has fewer olfactory receptor genes but more trace-amine-associated receptor genes (genes that sense the presence of amines in the environment). In the oceanic depths of the hostile, barren hadal zone, there is no need for many visual or olfactory senses. However, snail fish who can more acutely sense amines are at an advantage, because at great ocean depths, scavenged material is being degraded into edible amines (Jiang et al., 2019). Animals often have genes that reflect the constraints of their surroundings. Sensory adaptations therefore reflect the ongoing relationships between animals and their specific ecological niches.

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