Chem. Senses 25: 591–592, 2000

LETTER TO THE EDITORS

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Dear Editors

We would like to comment on the recent article by Laska *et al.* published in the journal (Laska *et al.*, 2000).

The olfactory tests performed in the squirrel monkey to determine its olfactory sensitivity to a panel of odorants are convincing. However, several points need to be clarified:

1. In neither the introduction nor the discussion is a distinction made between olfaction (odor perception) and pheromone-based communication, two different systems of chemical communication mediated in mammals by different receptors, different organs (olfactory epithelium and vomeronasal organ) and different neuronal pathways (olfactory bulb–olfactory cortex and accessory olfactory bulb–hypothalamus).
2. Contrary to what is stated in this article, different teams have considered the differences in olfactory performance of different species as an evolutionary adaptation. By studying the olfactory receptor (OR) gene repertoire in different mammals, we have shown that in primates a high fraction of these genes have evolved as non-functional pseudogenes (Rouquier *et al.*, 1998a,b, 1999, 2000). Hominoids such as humans or chimpanzees possess on average 50% of OR pseudogenes, Old World monkeys >25%, whereas New World monkeys, such as the squirrel monkey and marmosets, as well as rodents (mouse) seem devoid of pseudogenes. We hypothesized that under relaxed selective constraints (low selective pressure), hominoids have accumulated pseudogenes during evolution and that this could parallel the evolution of sensory function. In light of these results we are not surprised that squirrel monkeys display a well developed sense of smell. Another team (J. Freitag and H. Breer) reached similar conclusions studying the OR gene repertoire in aquatic mammals (Freitag *et al.*, 1998, 1999). For example, in dolphins, which have an underdeveloped olfactory epithelium and olfactory bulb, 100% of the OR genes are pseudogenes, probably because this animal has no need to smell volatile odorants and consequently, in the absence of selective pressure, its whole OR gene repertoire has accumulated deleterious mutations.
3. We agree with Laska *et al.* that the notion of 'microsmatic' or 'macrosmatic' should be somewhat revisited. It is likely that primates should not be generally considered as microsmates, but that different groups display different olfactory abilities, with New Word monkeys probably having the highest. Nevertheless, despite comparative experiments on detection thresholds for various odorants in different species, it is, for example, obvious that dogs have a more developed sense of smell than humans, since trained dogs are able to detect hidden objects (mines, drugs) or buried people after natural disasters by smell.
4. It is also difficult to compare the olfactory performance of various species reported in different works and subject to different experimental protocols. Even in the same species, different studies may report strikingly different results, as explained in the article by Laska *et al.* (Laska *et al.*, 2000). Furthermore, we cannot exclude the possibility that different species might exhibit different behaviors or learning/training capacities during the psychophysical tests that could bias the results.
5. New World monkeys certainly must be distinguished from the other primates since they are the only group unequivocally known to possess an intact vomeronasal organ.

Finally, in agreement with this article, we hypothesize that there is a parallel between the functional fraction of the OR gene repertoire and the olfactory performance of different animal species as a consequence of evolution, although nothing is known about the factors specifically involved in olfactory sensitivity, discrimination power or the ability to detect a wide range of odorants.

References

Freitag, J., Ludwig, G., Andreini, P., Roessler, P. and **Breer, H.** (1998) *Olfactory receptors in aquatic and terrestrial vertebrates*. J. Comp. Physiol., 183, 635–650.

Freitag, J., Beck, A., Ludwig, G., von Buchholtz, L. and **Breer, H.** (1999) *On the origin of the olfactory receptor family: receptor genes of the jawless fish (*Lampetra fluviatilis*)*. Gene, 226, 165–74.

Laska, M., Seibt, A. and **Weber, A.** (2000) *Microsmatic primates revisited: olfactory sensitivity in the squirrel monkey*. Chem. Senses, 25, 47–53.

Rouquier, S., Taviaux, S., Trask, B., Brand-Arpon, V., van den Engh, G., Demaille, J. and **Giorgi, D.** (1998a) *Distribution of olfactory receptor genes in the human genome*. Nature Genet., 18, 243–250.

Rouquier, S., Friedman, C., Delettre, C., van den Engh, G., Blancher, A., Crouau-Roy, B., Trask, B. and **Giorgi, D.** (1998b) *A gene recently inactivated in human defines a new olfactory receptor family in mammals*. Hum. Mol. Genet., 7, 1337–1345.

Rouquier, S., Stubbs, L., Gaillard-Sanchez, I. and **Giorgi, D.** (1999) *Sequence and chromosomal localization of the mouse ortholog of the human olfactory receptor gene 912-93*. Mamm. Genome, 10, 1172–1174.

Rouquier, S., Blancher, A. and **Giorgi, D.** (2000) *The olfactory receptor gene repertoire in primates and mouse: evidence for reduction of the functional fraction in primates*. Proc. Natl. Acad. Sci. USA 97, 2870–2874.

Accepted July 18, 2000