Zoological Studies 34, Supplement I (1995)

Zoological Studies

Distribution of Taste Pores and Ultrastructural Organization of Gustatory Cells in Gerbil Vallate Taste Buds

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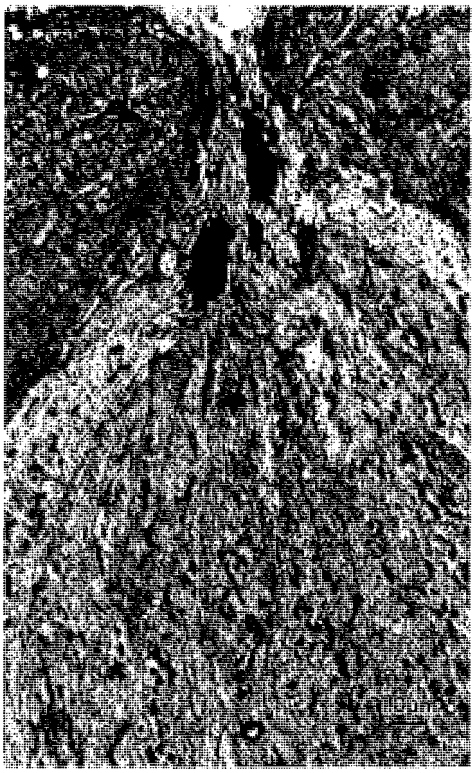
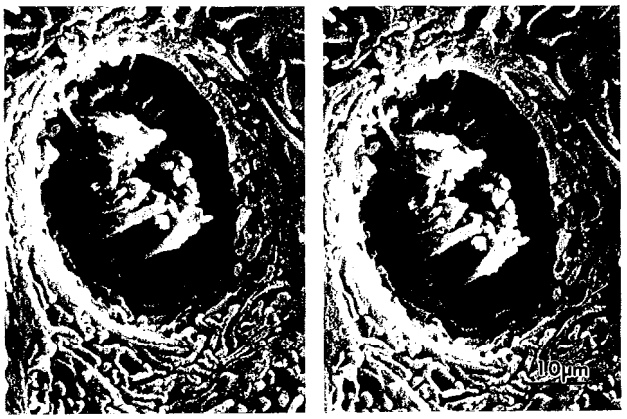
The gerbil, a desert animal, is different from other rodents such as rat, mice and others, because it can survive under extremely dry conditions due to its great capacity to conserve water. In a recent review, Schiffman and Gatlin (1993) proposed that the sense of taste conveys the attractive properties of foods (five primary taste properties: salty, sour, sweet, bitter and umami) that promote and maintain food intake. They also inferred that taste not only play a role in protection against harmful substance but also contribute significantly to nutritional status as well as to the quality of life. Consequently, it is reasonable to expect that the ultrastructure of gerbil's taste bud may different from that of other rodents. However, to our knowledge so far, we retrieved only one abstract concerning the ultrastructure of the gerbil taste bud in fungiform papilla (St. Joer and Kinammon 1987) and no other previous reports have been published. Moreover, the quantification on the distribution of the taste bud in the gerbils is lacking. In order to extend our knowledge about the taste capacity and the ultrastructure of the taste bud in gerbils, we determined to analyze the surface ultrastructure and distribution of taste pores by scanning electron microscopy and to characterize the ultrastructure of gustatory cells by transmission electron microscopy in the gerbil vallate papilla.

In the gerbil, a single vallate papilla was located on the midline of the tongue root. It comprised two separated trenches (about 800) μm in length and 300μm in depth), which were separated more widely at the rostral end than at the caudal end. The lingual epithelium on the dorsal surface of the papilla is parakeratinized and that on the trench wall is nonkeratinized or slightly keratinized.

Transmission electron microscopy revealed that the taste pore of the gerbil vallate taste buds was populated by a tuft of microvilli (equivalent of taste hairs at light microscopic level) among which an electron-dense material filled all the intervillous spaces. Four types of taste cells were identified by their ultrastructural characteristics: type I, II, intermediate and basal cells, and each type comprised about 78%, 14%, 5% and 1-2% of the total taste cell population, respectively (Fig.1).

Taste buds distributed randomly on both lateral and medial sides of the trench wall in roughly equal number as estimated by the number of taste pores on the exposed trench wall surface (Fig.2). The





total number of taste pores observed is 342 from four different vallate papillae with an average of 85±1.67 (mean ± standard error of mean) taste pores per papilla (N=4). The distribution density on the trench wall is 1.89 ± 0.5 taste pores per 1000 μm^2 (N=8; from either medial or lateral wall of the trenches in five papillae). There were more numerous taste pores on the caudal end than on the rostral end. Figure 3 is a stereopair electron micrographs of a rather clean taste pore demonstrating a tuft of microvilli of taste cells underneath the pore. It is revealed that the taste pore was surrounded by layers of parakeratinized epithelial cells characterized by numerous microridges (microfolds or microreplicas) on the free surface. Frequently, the taste pore was so deep and hindered by the secretory material of the taste bud and the mucus of the oral mucosa, and therefore, no definite structures were identified.

This is the first report to reveal the ultrastructural organization and to demonstrate quantitatively the distribution of taste pores in gerbil vallate papilla. The present data will provide a firm basis for future comparative, immunocytochemical and neurological studies involving the gustatory system. Further studies on taste pore organization by freeze-fracture to investigate their intercellular junctions and the possible mechanism of gustatory neural transmission are in progress.

Supported in part by grants Nos. NSC-81-0412-B002-558 and NSC-82-0412-B002-407 from National Science Council, Taiwan, ROC.

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