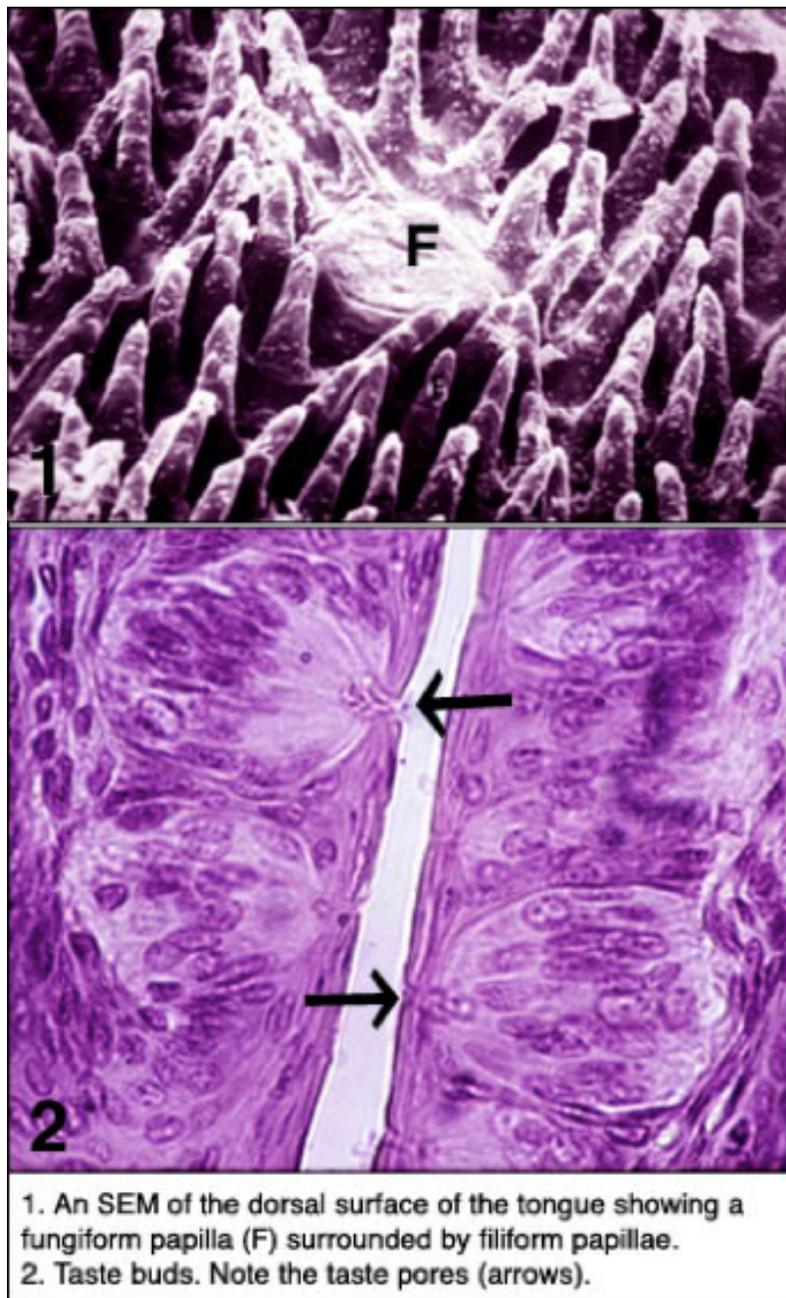


## Tongue



1. An SEM of the dorsal surface of the tongue showing a fungiform papilla (F) surrounded by filiform papillae.  
2. Taste buds. Note the taste pores (arrows).

The mucous membrane of the tongue is firmly bound to a core of skeletal muscle, and there is no submucosa. The tongue musculature is formed by interwoven fascicles that run in three planes, each perpendicular to the other. The undersurface of the tongue is smooth, whereas the anterior two-thirds of the dorsal surface shows numerous small protuberances called papillae. The posterior one-third lacks papillae but shows mucosal ridges and mound-like elevations. The latter result from the underlying lymphatic tissue of the lingual tonsils.

Four types of papillae are associated with the anterior portion of the tongue. Filiform papillae are 2 to 3 mm long and contain a conical core of connective tissue that is continuous with the underlying lamina propria. The covering stratified squamous epithelium shows variable degrees of cornification. They are the most numerous type of papillae. The mushroom-shaped

fungiform papillae are scattered singly between the filiform type. They are most numerous near the tip of the tongue, where they appear as small red dots. The color is due to the richness of capillaries in their connective tissue cores. Taste buds may be associated with this type of papilla. Circumvallate papillae, the largest of the papillae, are located along the V-shaped sulcus terminalis that divides the tongue into anterior and posterior regions. They number 10 to 14 in humans. The circumvallate papillae appear to have sunk into the mucosa of the tongue and are surrounded by a wall of lingual tissue, from which they are separated by a deep furrow. Each contains a large core of connective tissue with numerous vessels and small nerves. Occasionally, small serous glands may be present. The epithelium covering the lateral surfaces of these papillae contains numerous taste buds that may number 250 or more per papilla. Serous (von Ebner's) glands, lingual minor salivary glands, lie in the lamina propria and open into the bottom of the furrows. Their thin serous secretions continuously flush the furrow and provide an environment suitable for sensory reception by the taste buds. Foliate papillae are rudimentary in humans but in species such as the rabbit are well developed and contain many taste buds. They form oval bulges on the posterior, dorsolateral aspect of the tongue and consist of parallel ridges and furrows. Taste buds lie in the epithelium on the lateral surfaces of the ridges, and small serous glands drain into the bottoms of the adjacent furrows.

## **Taste Buds**

The normal human tongue contains about nine thousand taste buds. Taste buds are present in fungiform, circumvallate, and foliate papillae and may be scattered in the epithelium of the soft palate, glossopharyngeal arches, pharynx, and epiglottis. They appear as lightly stained, oval structures that extend from the basement membrane almost to the surface of the lining epithelium. A small taste pore allows for communication with the external environment. Taste buds consist of supporting (sustentacular) cells, between which are neuroepithelial cells; the cells are arranged somewhat like the segments of a peeled orange. Both types of cells have large microvilli called taste hairs that project into the taste pore and are embedded in an amorphous, polysaccharide material. Tastant molecules that enter the taste pore stimulate neuroepithelial cells. Binding of tastants with taste binding receptor proteins occurs on the microvilli of the neuroepithelial cells. The taste sensation is transmitted to club-shaped nerve endings that pass between both cell types of the taste bud but apparently make synaptic contact only with neuroepithelial cells. Depolarization of the neuroepithelial cells as a result of receptor binding stimulates the release of glutamate, which then generates an action potential in adjacent afferent nerve terminals. Peripheral and basal cells, also associated with taste buds, are thought to represent undifferentiated progenitors of the supporting and neuroepithelial cells. Five taste sensations are perceived: bitter, sweet, salty, sour, and umami. The sensations may be detected regionally in the tongue -sweet and salty at the tip of the tongue, sour at the sides of the tongue, and bitter in the area of the circumvallate papillae - but structural differences in taste buds from these areas have not been seen. Stimulation of the umami receptor results in foods that are ingested to "taste good".