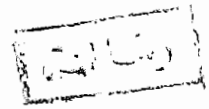
DISORDERS OF TASTE SENSATION

Essay

Submitted in Partial Fulfillment forThe

M.Sc. Degree

in Otolaryngology



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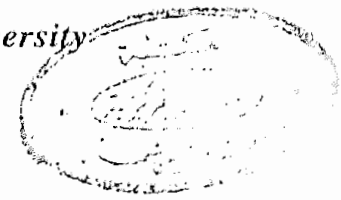

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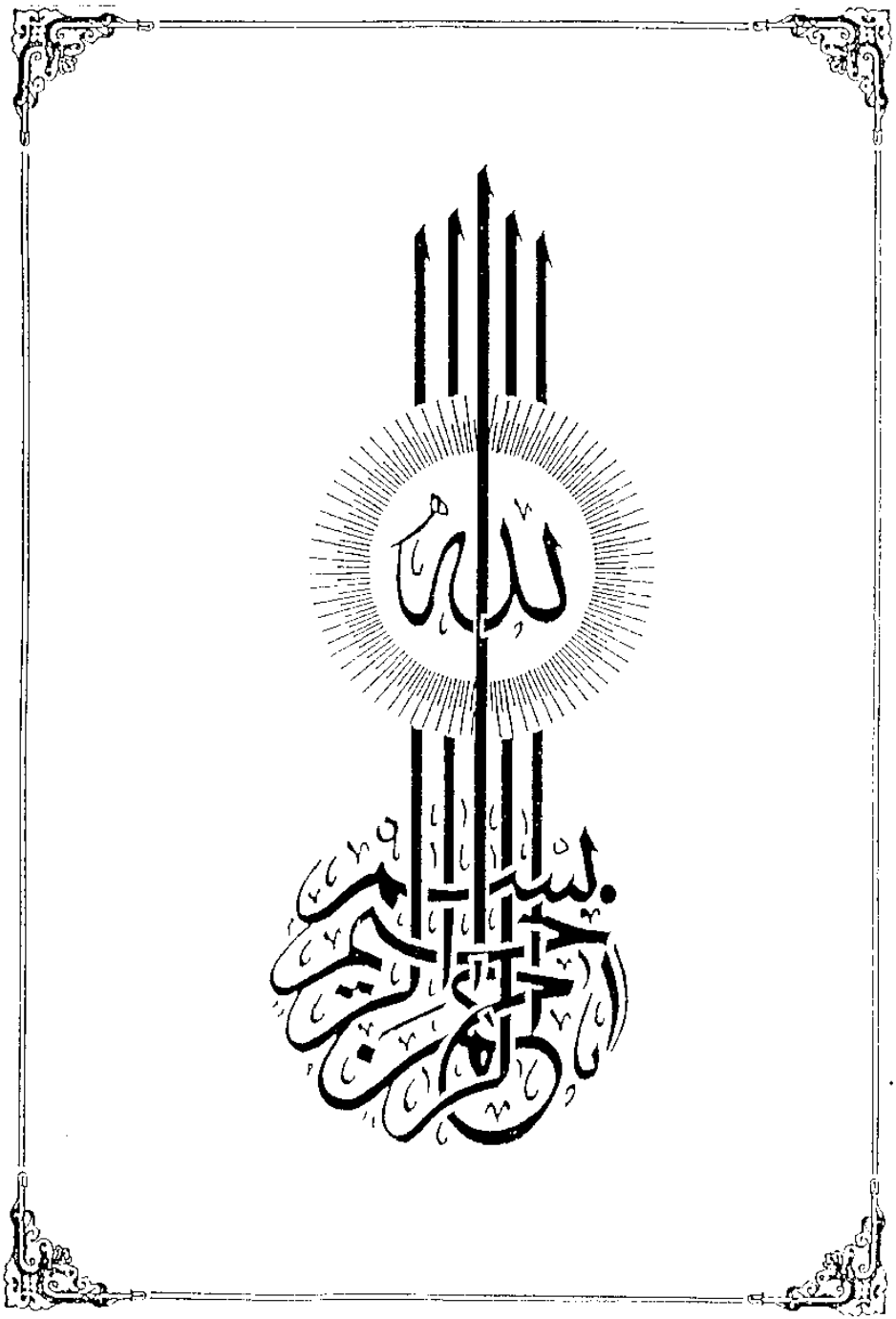
My Best Wishes

To My Parents



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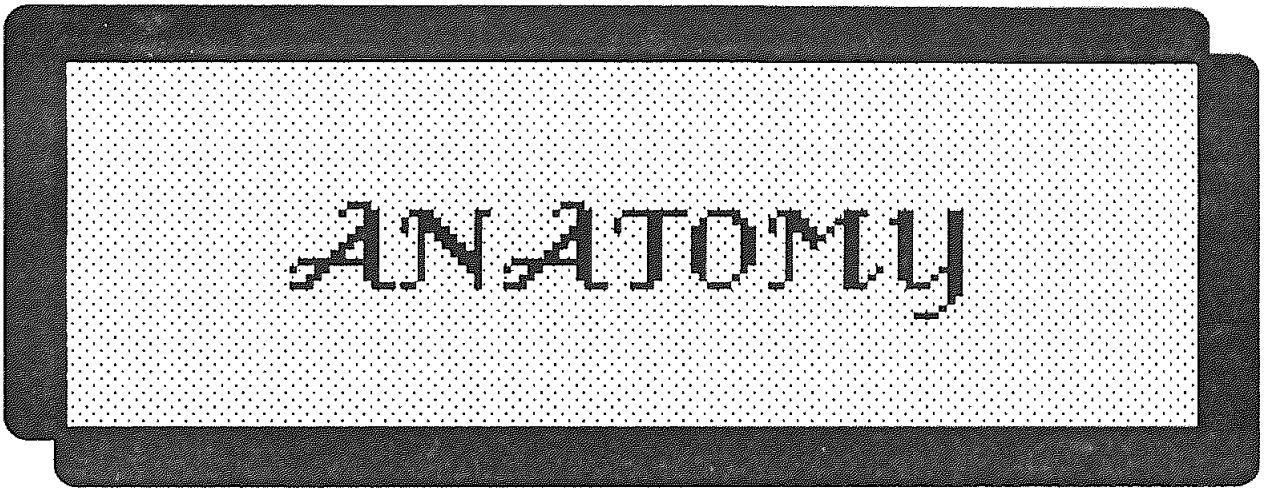
Chapter (1)
INTRODUCTION

Taste sensation is a chemosensory sensation percieved by many organs ranging from the tongue to the upper part of oesophagus. it plays an Important role in feeding through preparation of alimentary system to the coming food (conditioning reflex). Also it has a protective role against unplatable substances. The complexity of this system makes the patient presenting with a complaint of taste dysfunction often difficult to diagnose and treat . Sometimes this type of patient has been to a number of health professionals in an unsuccessful attempt to get help for the problem . much of the difficulty in dealing with such patient lies in general lack of knowledge about taste and its disorders . A dysfunction of taste can occur as a secondary process in a number of disease states. At other times , a patient's primary complaint is a reduced ability to taste or distorted chemosensory experience. Several recent reviews have addressed these clinical problems.

The aim of this work is to review the current literature for the etiology , investigations, diagnosis and possible treatment of taste disorders if found.


ANATOMY

Chapter (2)

ANATOMY OF THE GUSTATORY SYSTEM

The sense of taste is mediated through chemical stimulation of taste buds,which are composed of receptor cells, supporting cells, and nerve fiber terminal. Taste buds are often contained within distinct papillae, particularly those on the tongue .

At the ultra structural level, at least two kinds of cells can be descerned within the taste bud . These are termed dark cells and light cells on the basis of the presence or lake of dense granules in their optical portion .These receptor cells are modified epithelial cells that arise continually from an underlying layer of basal cells. It is not clear, primarily because the cells are in constant state of turnover, whether they are cell types or a single type at diffrent maturational stages. The cells in the taste bud are arranged in a concentric columnar fashion with their apical microvilli projecting towards a pore that opens through the epithelium into the oral cavity. The base of the taste bud is penetrated by branches of the afferent nerve which make synaptic contact with the receptor cells.Taste receptor cells undergro constant turnover, with replacment cells arising through mitosis of the underlying basal cells. In the rat, the life span of a taste cell in fungi-form papilla is approximatly 10 days. A single

nerve fibre may innervate more than one taste papillae, each of which may contain many taste buds, each innervated by several afferent fibres. The afferent nerve maintains a trophic influence over the taste buds, which will degnerate if the nerve supply is removed. Although the innervation by gustatory nerve fibres is necessary to mintain the integrity of the taste bud, the specificity of the receptor cells is not determined by the particular nerve involved but the epithelium itself.

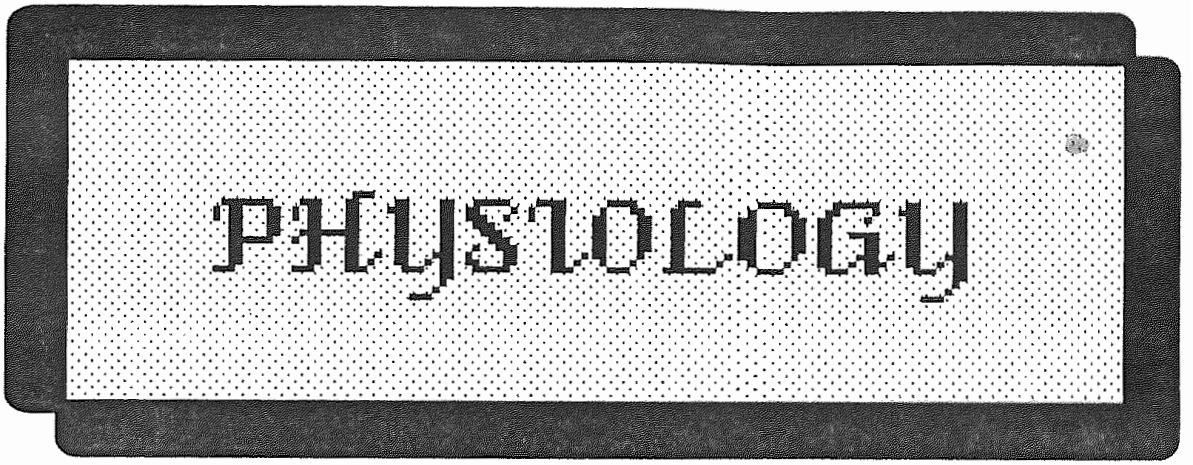
Taste buds are found on the tongue in fungi-form papillae anterior to sulcus terminals and in circumvallate and foliate papillae posterior to this boundary. There are also taste buds on the soft palate, pharynx, epiglottis, and upper third of the esophagus. In humans, there is an average of 33 fungi-form papillae on the anterior portion of the tongue, containing approximately 114 taste buds, although there are considerable variation among individuals.The 8-12 circumvallate papillae contain about 250 taste buds each, for a total of nearly 3000 taste buds, and the foliate papillae have about 1280 taste buds. Although taste buds have been described on the soft palate of human adults only in biopsy material and in a very small number. Human infants are reported to have about 2583 taste buds in the pharynx and larynx and on the soft palate. These numbers, however, are derived from very few studies on the tongue of the adult rhesus monkeys (fungiform, cicumvallate,

and foliate papillae), they are approximatly 8000 to 10,000 taste buds which are maintained well into old age. A complete quantification of taste bud dstribution in the hamster,an animal commonly used for electrophysiologic investigation of taste, demonsterated a total of 723 taste buds with 18 percent located in fungi-form papillae 23 percent in a circum vallate papillae , 32 percent in the foliate papillae ,1 2 percent on the soft palate , and 10 percent on and near epiglottis . an additional 5 percent are located in small numbers on the buccal walls and the sublingual organ and the nasoincisor ducts. Most electrophysiologic studies of taste have employed stimulation of the fungi-form papillae, even though the majority of taste buds in all mammillian species studied are located in other areas.

Taste receptors are innervated by branches of three cranial nerves.Taste buds in the fungi-form papillae on the anterior portion of the tongue are innervated by chorda tympani branch of the facial nerve, and those on the soft palate are innervated by its greater superficial petrosal branch. the cell bodies of these afferent fibres are located in the geniculate ganglion and project centrally into the rostral pole of the nucleus tractus sloitarius. Circumvallate and most foliate taste buds are supplied by the glossopharyngeal nerve, although the most rostral foliate taste buds are innervated by the chorda tympani nerve. Afferent fibers of the glossopharngeal nerve project through the inferior glossopharngeal (petrosal) ganglion to

the nucleus of the solitary tract just caudal to, but overlapping with, the facial nerve termination. Taste buds on the epiglottis, caudal pharyx and and esophagus are innervated by the internal portion of the superior laryngeal branch of the vagus nerve. Afferent fibers from the superior laryngeal nerve project via thier cell bodies in the inferior vagal (nodose) ganglion to nucleus solitarius caudal to but overlapping with the glossopharyngeal nerve termination.

From this termination within the nucleus of the solitary tract, Secondary gustatory fiber arise to project rostrally more or less parallel to the projection of general visceral sensation arising from the more caudal aspects of the solitary ncleus . In the most mammalian species, there is third - order projection into the parbracial nuclei in the pons, from which fibres arise to project via a classic sensory path to the posterior ventromedial nuclues of the thalamus and then to the insular cortex .In addition to this thalamocortical projection fibres also travel from pons into areas of ventral forebrain involved in feeding and autonomic regulation, including the lateral hypothalamus, central amygdala, and the red nucleus of the stria terminalis. recent work, however, has suggested that in the monkey, taste fibres bypass the pontine relay and project directly to the thalamus. There are unfortunately, no modern data on the anatomy of these projection in humans. *(Gray's , 1980)* .


PHYSIOLOGY

Chapter (3)

PHYSIOLOGY OF TASTE .

Many textbooks of physiology show diagrams of the human tongue that suggests that saltness and sweetness are appreciated on the tip, sour on the sides and bitterness on the back of the tongue. Although there are a different taste quantities in different regions of the tongue and the palate all taste quantities (salty, sour sweet, and bitter) can be received in all regions. Further across the anterior portion of the tongue there is no interaction between the size of the area stimulated and the magnitude of the sensation for the different quantities, that is, receptos for the various quantities are not diffrentially distrubuted across tongue The suggestion by Von Bekesy that the individual papillae are selectively responsive to different taste qualities has been refused by a number of investigators.

A lack of specificity of single taste papilla concides well with the fact that individual papilla contain several taste buds, each of which is composed of number of receptor cells Electrophysiologic recordings from individual mammalian receptor cells have further demonstrated that even single receptor neurons are responsive to more than one quality of taste. The receptor mechanisms for stimuli with different taste quantities must therefore coexist within a single

cell. The nature of these transduction mechanism is currently an area of much interest.

Most of what is known about neurophysiology of the mammalian gustatory system has been derived from studies on the input from the anterior portion of the tongue . Like indivdual receptor cells, single fiber in the chorda tympani nerve typically respond to more than one taste quality. Individual second and third-order gustatory neurons in the nucleus tractus solitarius parabrachial nuclei are similarily, broadly turned across taste quality. Recent work on fibres in glossopharyngeal nerve demonstrates a lack of stimulus specificity in the the fibers responsiveness.

However even in the face of this broad tuning ,individual gustatory, cells can be categorized on basis similar to their response profiles and their predominant sensitivities, that is, they can be placed into functional groups. Attempts to understand the neural processing of taste quality information have relied heavily on this kind of classification, which depends upon the existence of four basic taste qualities ,salty, sour, sweet, and bitter.

An interesting question in light of the broad tunning of taste receptor cells and first-order fibres is how any kind of code for quality can be maintained in the face of the constant turnover of receptor cells. Electrophysiologic work cross-regenerated taste

fibers in which the seventh and the ninth cranial nerves were cut crossed, and allowed to reinnervate the tongue, demonstrated that the tongue epithelium determined the relative sensitivities of the two nerves. This was some what surprising, since the nerves themselves have a trophic influence over the taste buds. Nevertheless some mechanism in the taste epethelium is responsible for determining the qualitative sensitivities of the taste recoptors. The constant regeneration and replacement of receptor cells, implies that conditions which alter the structure or function of these cells, such as drugs, radiation , trace metal imbalances, or infections, may have only a temporary effect on taste . ***(Lancet D., 1986)***

The gustatory system readily adapts to constant . For example, flowing sodium chloride over the tongue for 60 second results in a complete disappearance of the salty sensation. Taste receptors are particulary sensitive to changing stimuli. Indeed, the natural course of events in tasting involves intermittent and rapid contact of the various taste buds as stimuli are moved through the oral cavity during biting, chewing, and swallowing. Because of the rapid adaptation to constant stimulation, care must be taken in gustatory testing procedures to guard against sensitivity caused by prolonged and repeated stimulation .