

MChB 3 - 2005

Taste & Smell

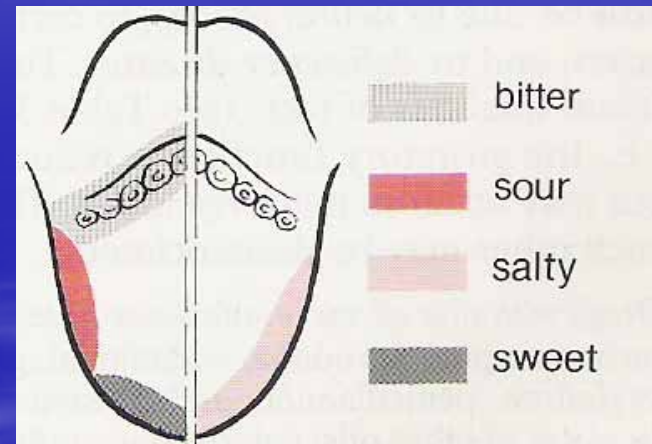
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Taste

- Basic sensations

- bitter
- sour
- salty
- sweet



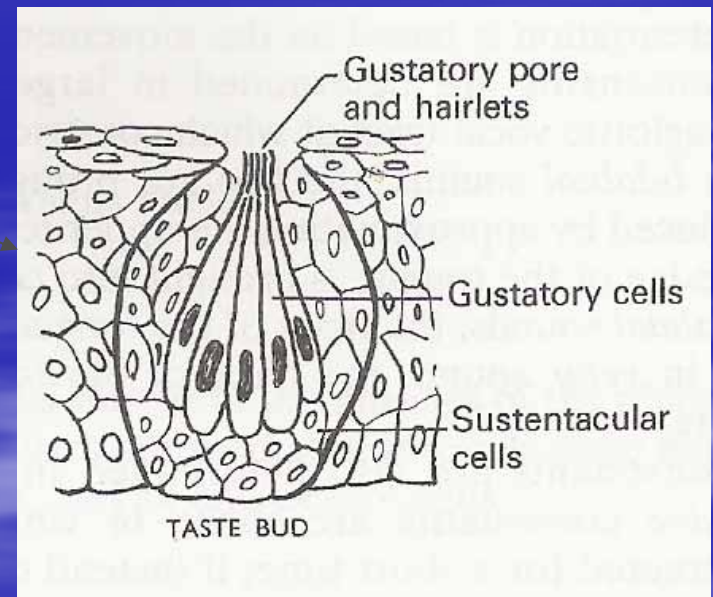
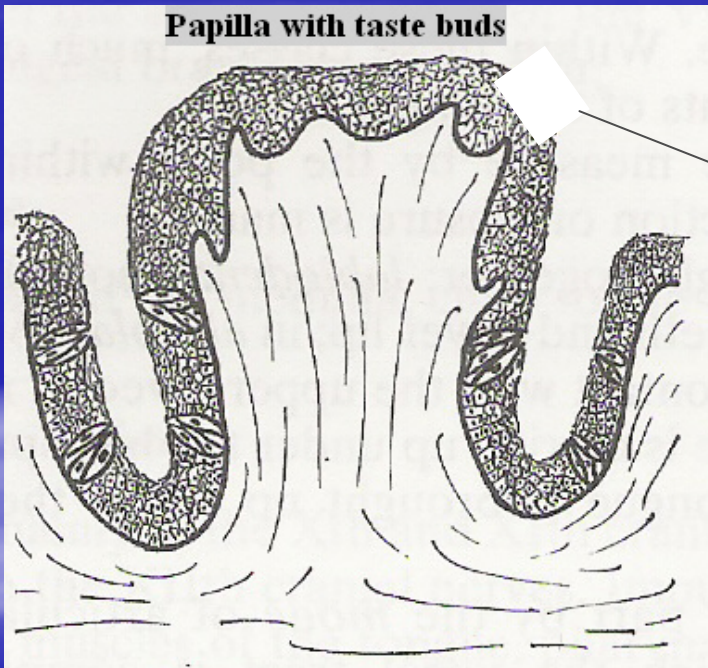
Pure sensory (touch) fibres of tongue may also be stimulated by sour and spice

Taste

- All other tastes are mixed sensations in which sense of smell also integrated
- Many foods are “tasted” by CN I (olfactory)

Taste

- Sensory organs - taste buds

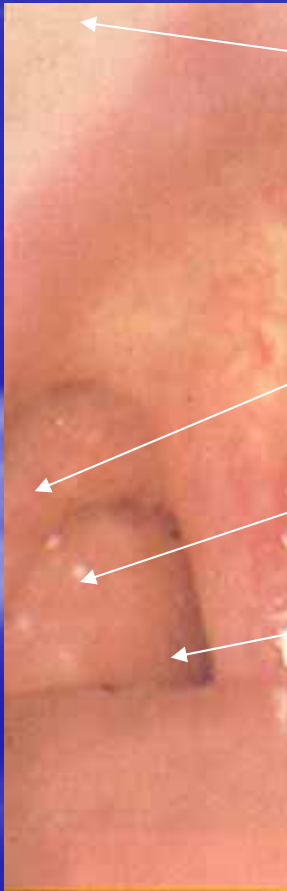


Taste

- Taste buds

- found in

- **papillae of tongue**



- hard palate

- anterior tonsillar pillar

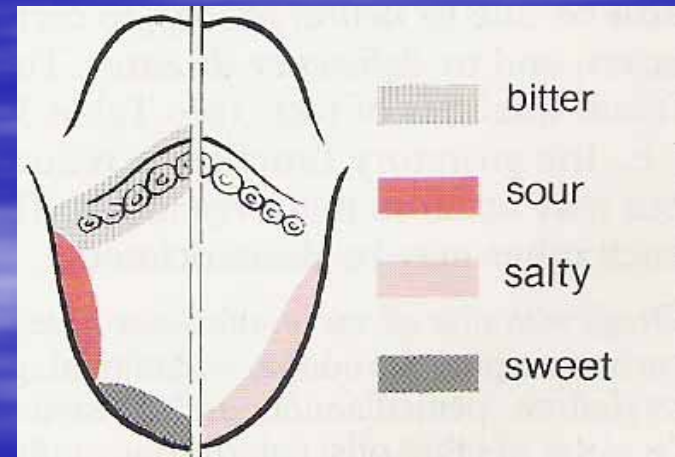
- tonsil

- posterior pharyngeal wall

- buccal mucosa

Taste

- Fine hair cells of the papillae must be bathed in saliva or other fluids to allow sense of taste to be evoked
- Topical arrangement of different taste qualities on tongue



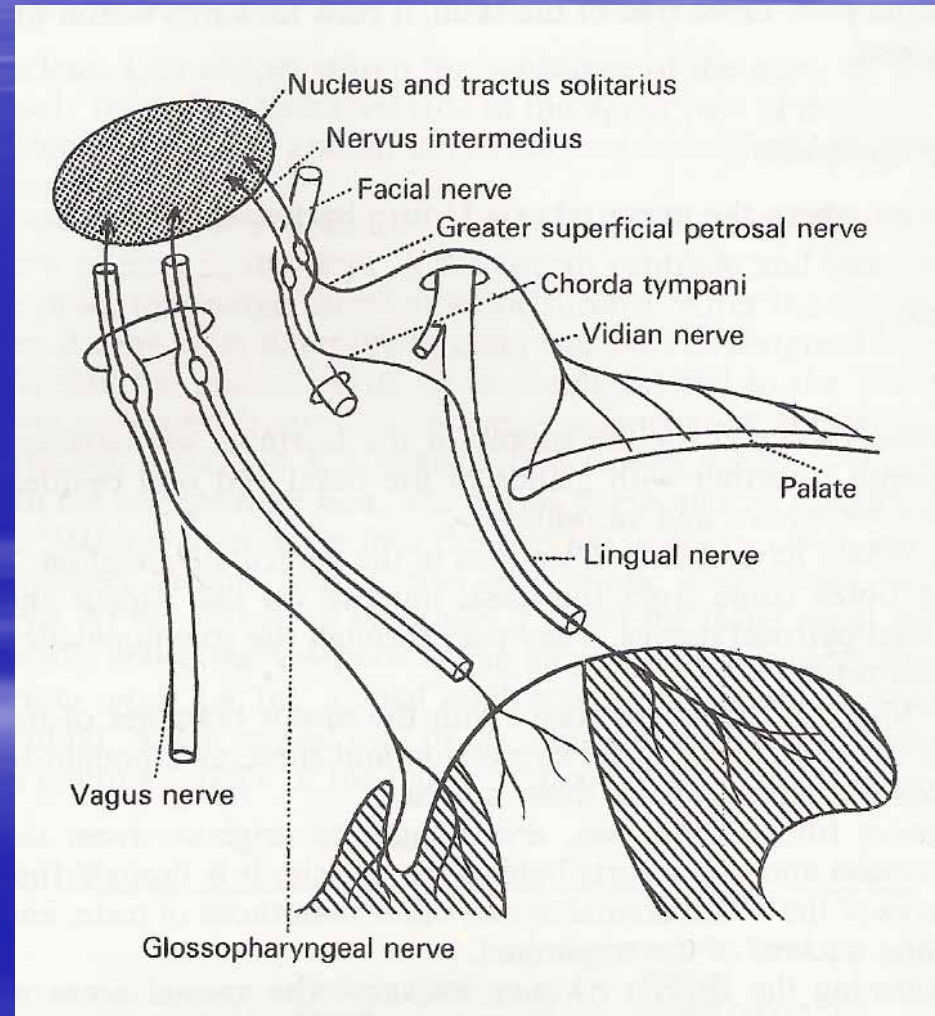
Taste

- Nerve supply

- chorda tympani (~ VII)
- lingual nerve (~ V₃)
- Glossopharyngeal (IX)
- Vagus (X)

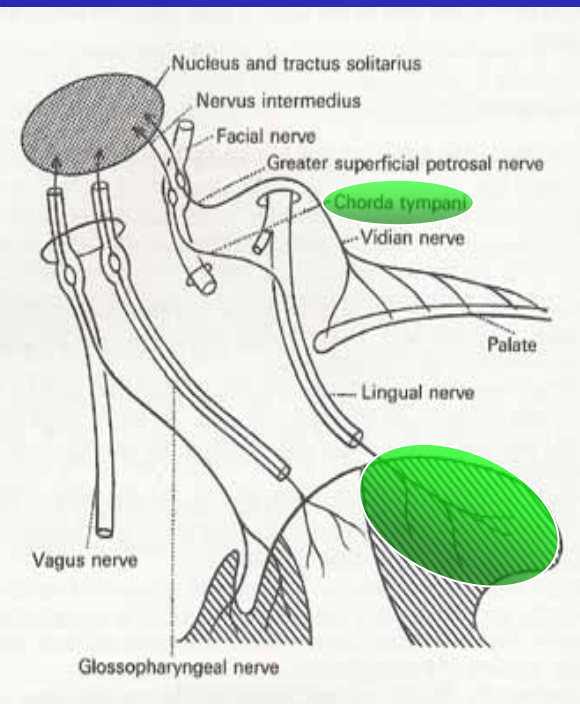
Taste

- Nerve supply
- taste pathways



Taste

- Nerve supply



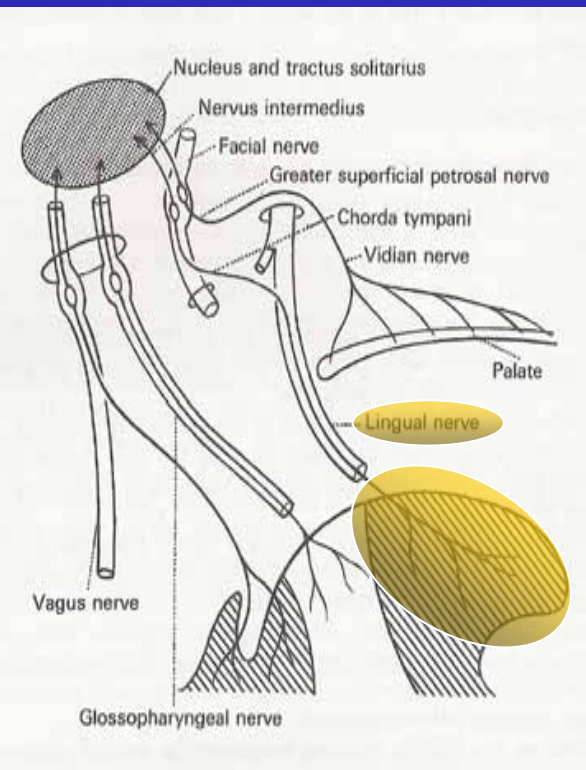
- chorda tympani (~ VII)
- anterior $\frac{2}{3}$ tongue

Taste

- Nerve supply

- lingual nerve ($\sim V_3$)

runs with chorda tympani
and supplies anterior tongue

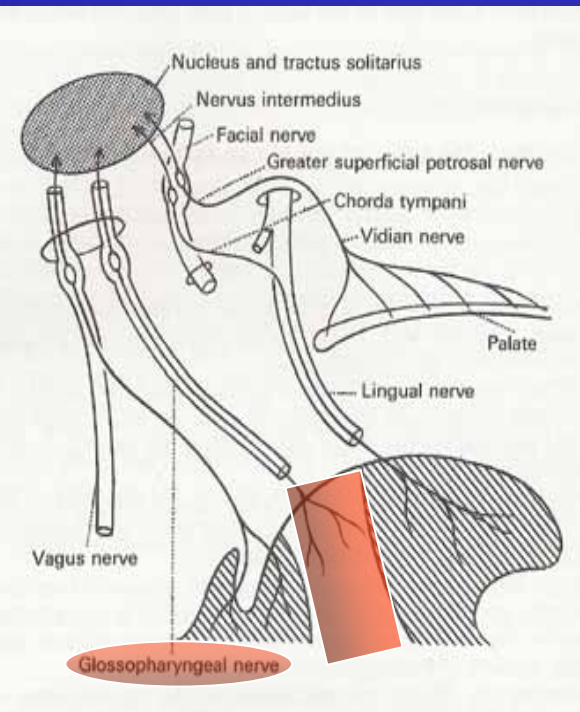


Taste

- Nerve supply

- Glossopharyngeal (IX)

- posterior $\frac{1}{3}$ tongue
- walls of oropharynx



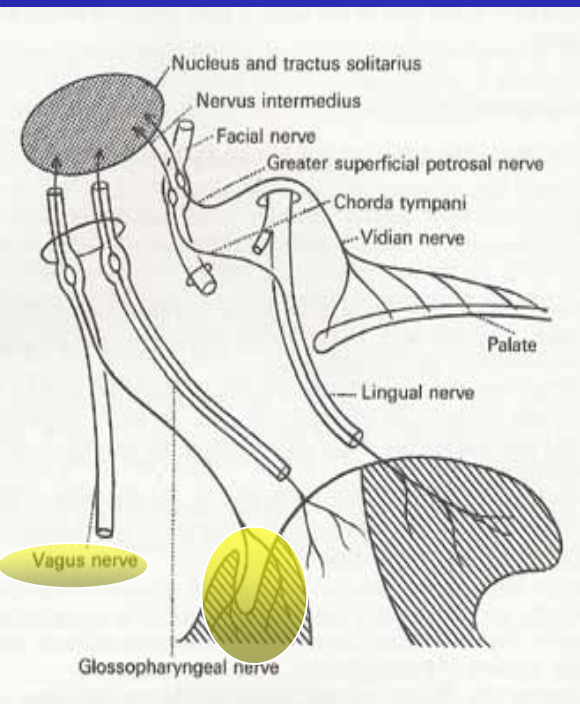
Taste

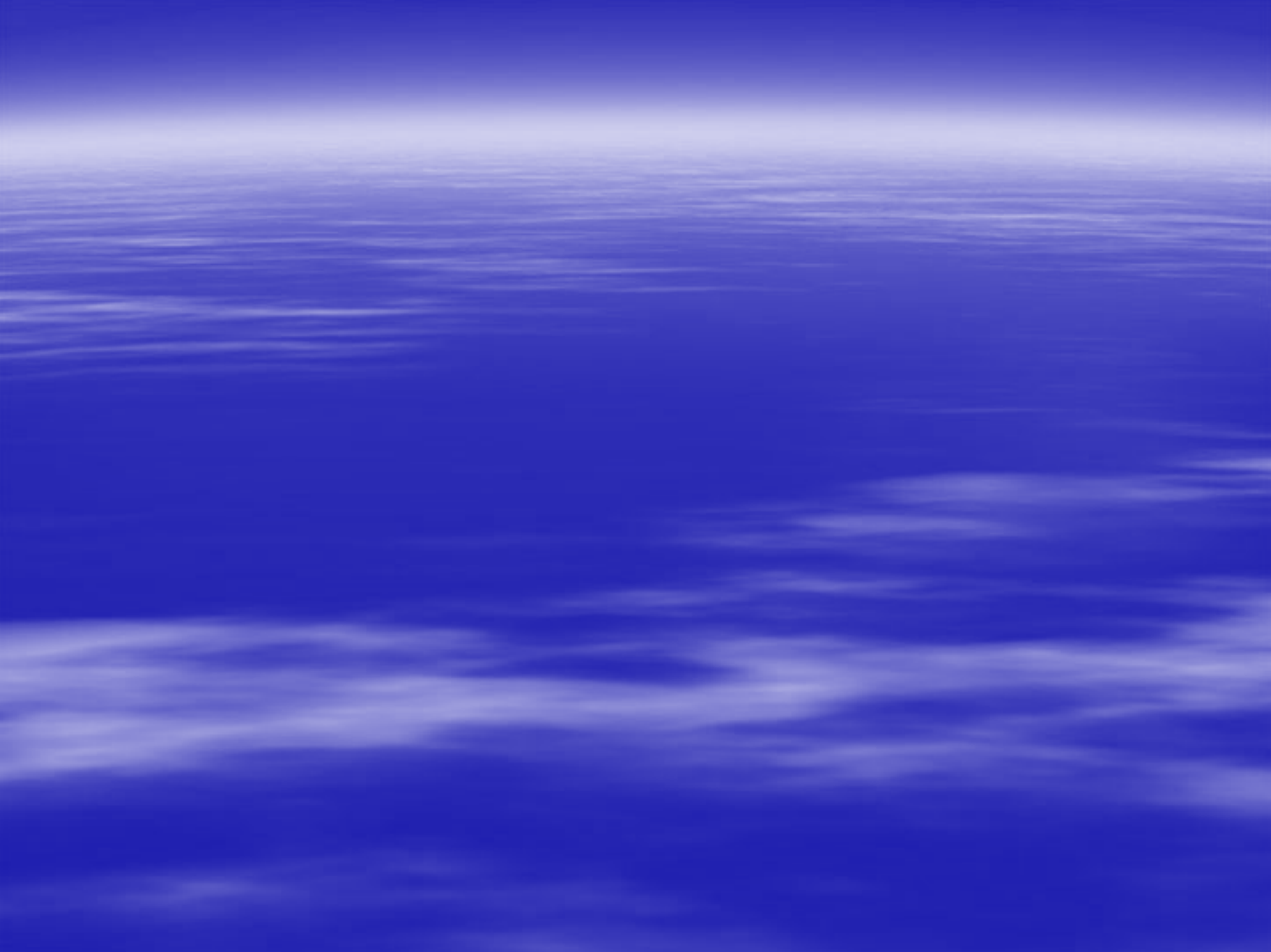
- Nerve supply

- Vagus (X)

- epiglottis

- laryngeal “inlet”





Disorders of taste

- Hypogeusia

- reduced sensitivity
 - radiotherapy
 - mechanical damage - dentures
 - age (presbygeusia)
 - mucosal atrophy - glossitis
 - thrush
 - Sjögrens

Disorders of taste

- Hypergeusia
 - increased sensitivity
 - Glossopharyngeal neuralgia

Disorders of taste

- Ageusia

- absence of taste

- chorda tympani or VII lesion

- Bell's palsy

- otitis media

- ear surgery

- V & IX tumours and skull base lesions

- toxins

Disorders of taste

- Ageusia

- absence of taste
 - chorda tympani or VII lesion
 - toxins
 - alcohol
 - nicotine
 - mouthwashes
 - acids & alkalis
 - drugs

Disorders of taste

- Ageusia

- absence of taste
 - chorda tympani or VII lesion
 - toxins
 - drugs
 - aspirin
 - carbamazepine
 - levodopa
 - ethambutal
 - lithium
 - penicillamine

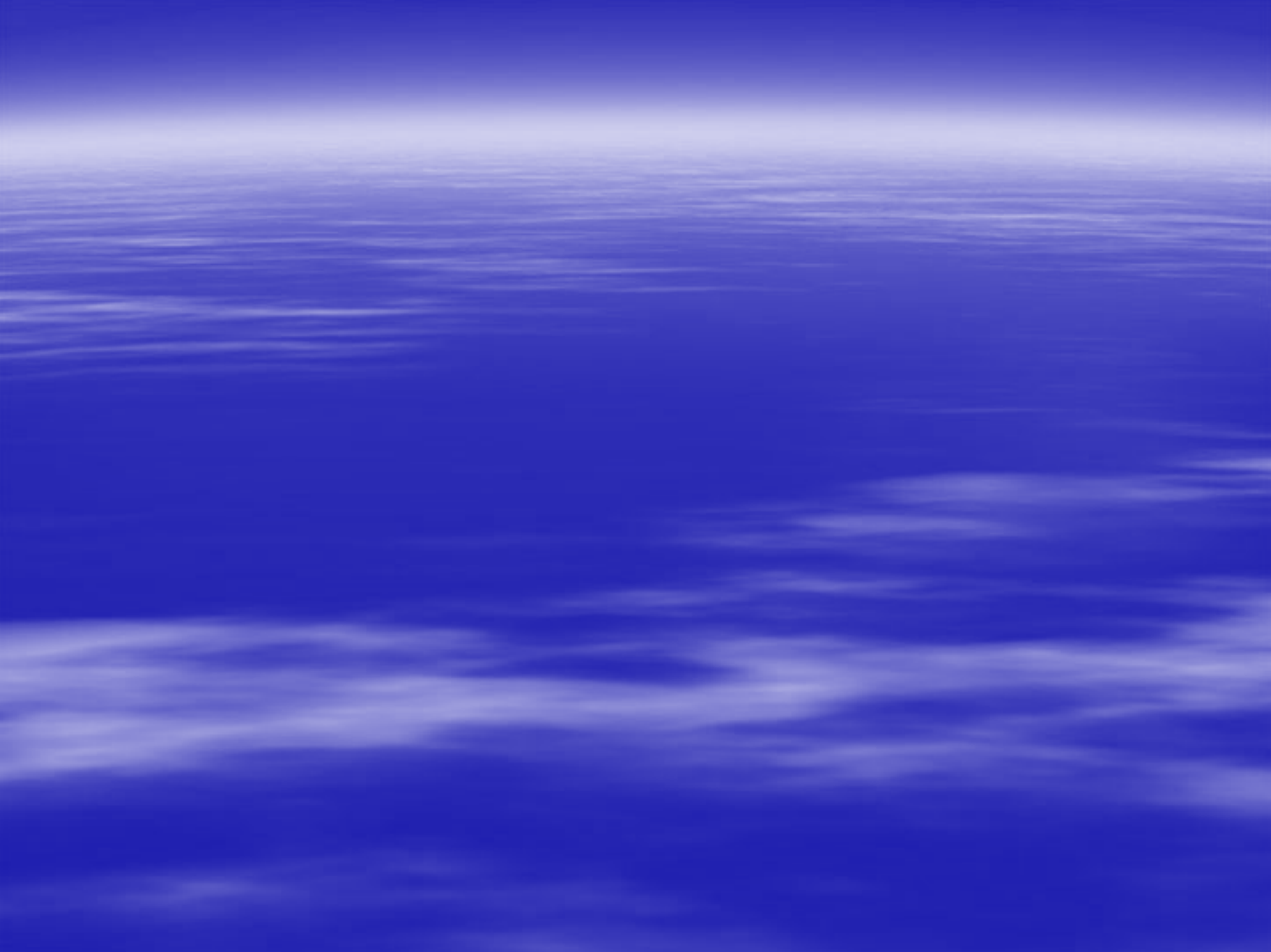
Disorders of taste

- Parageusia

- altered / faulty sensitivity
 - virus infections
 - carbon monoxide poisoning
 - cerebral cortical disease
 - pregnancy
 - diabetes mellitus
 - hypothyroidism

Examination of taste

- Extend tongue
- Test solutions placed on anterior $\frac{2}{3}$ of tongue
- Gives quantifiable reading of taste threshold
- No information concerning quality of taste



Smell

- The process by which an odorous substance stimulates the olfactory end-organ is not entirely known
- Recent evidence indicates that the odour of a substance is related to the shape of its molecules and to some extent its molecular vibrations

Theories of smell

- 'Primary' odours – receptors for each

ethereal


camphoraceous

musty

floral

pungent

putrid



All smells accounted for by
permutations of these receptors
stimulated to varying degrees

Theories of smell

- 'Primary' odours – receptor

... theory has not been substantiated

Theories of smell

- Receptor site configuration

insufficient variation in site shape for
wide variation of odours

? structural similarity between
substances that smell similar

Theories of smell

- Molecular vibration

marked similarity in smell between
substances with a close
frequency of vibration

Theories of smell

- Adsorption

molecule is adsorbed on to receptor membrane which it then penetrates

penetration causes local depolarisation of rate, amplitude & duration peculiar to molecular structure of 'trigger'

Theories of smell

- Smell is a complex process starting with stimulation of olfactory epithelium by air-borne aromatics
- Results in transmitted electrophysiological impulse along olfactory pathways

Theories of smell

- No wholly acceptable single theory has emerged
- Most probably combination

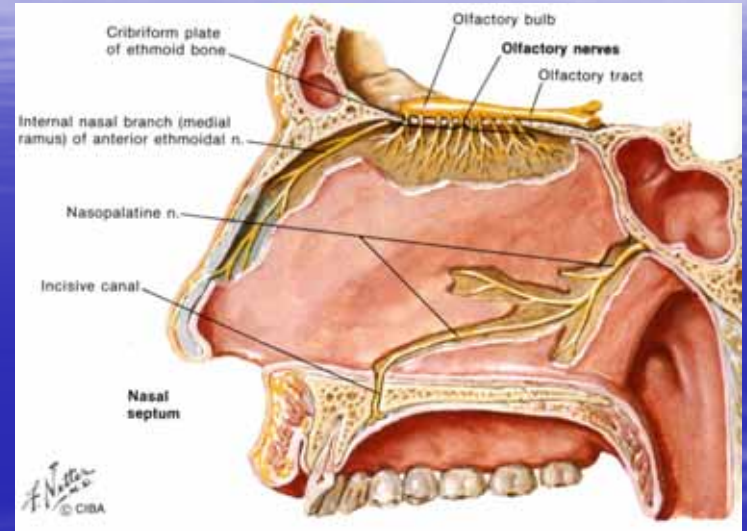
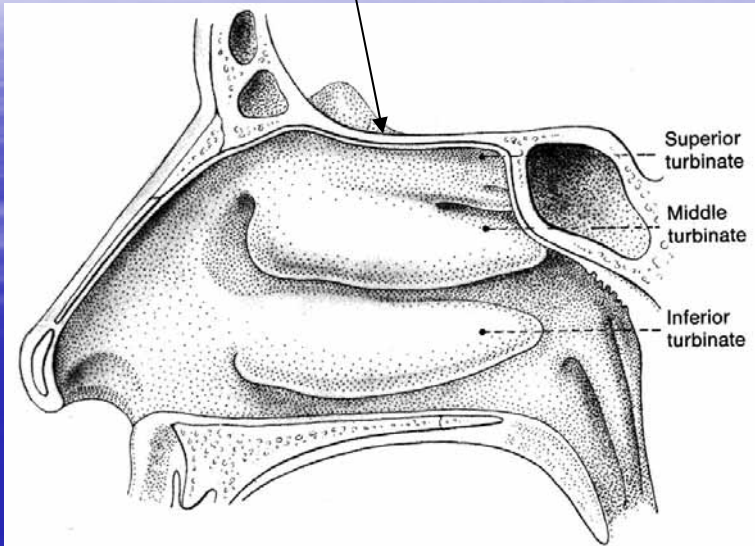
Olfactory mucosa — Schneiderian membrane

- The Schneiderian membrane lines:
 - upper $\frac{1}{3}$ of the nasal septum,
 - roof of the nose and
 - lateral wall,

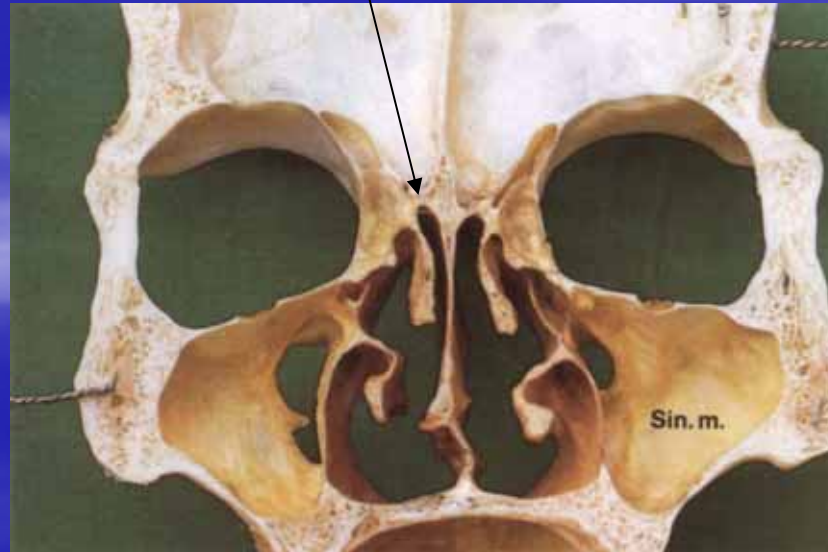
...above and including superior turbinate

Smell - anatomy

Cribriform plate



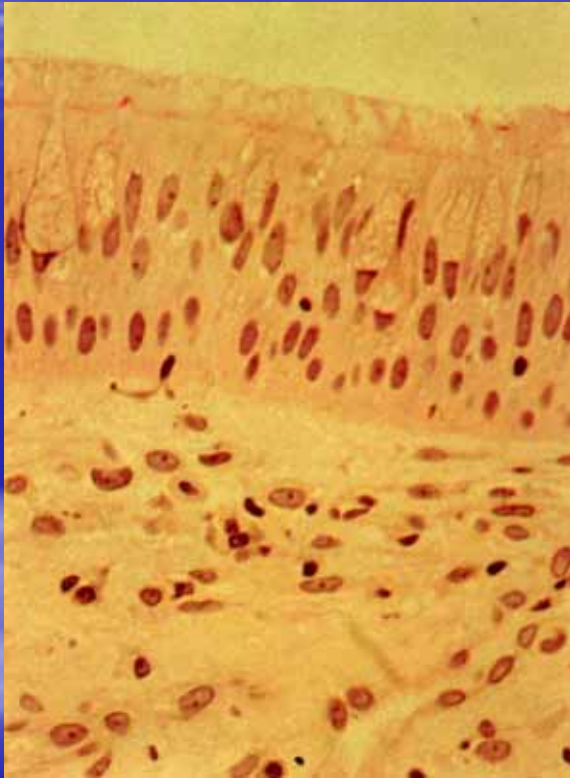
Cribriform plate



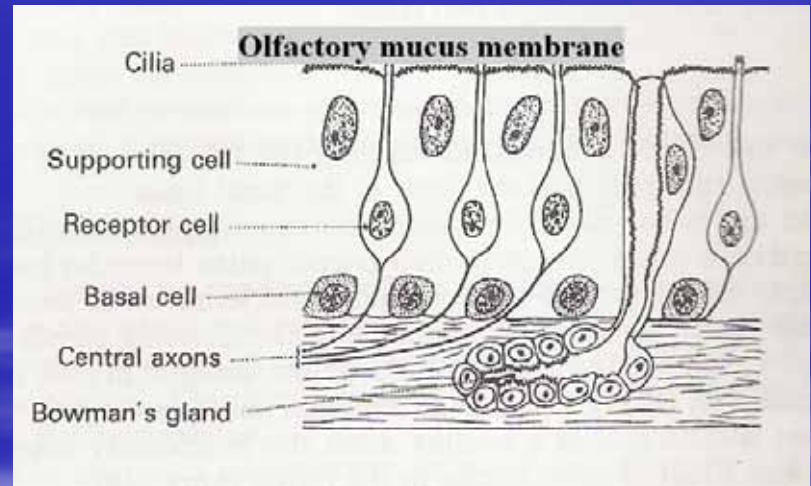
Olfactory mucosa — Schneiderian membrane

- This Schneiderian membrane is:
 - ... non-ciliated columnar epithelium with:
 - serous glands of Bowman
 - olfactory cells – terminate in
olfactory hairs / cilia
 - supporting cells
 - basal cells

Smell - anatomy

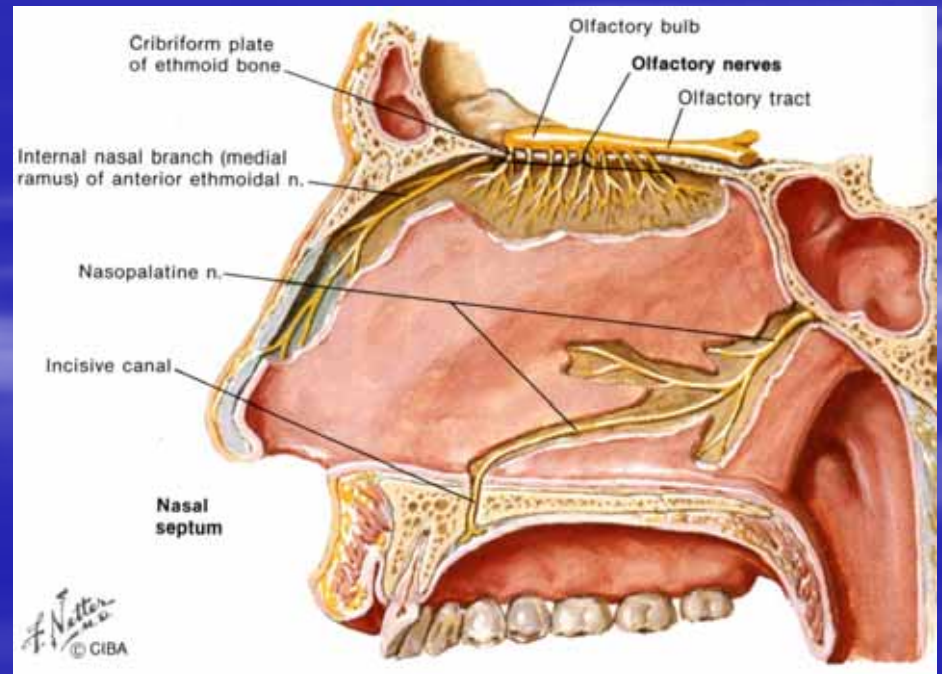


Olfactory epithelium



Olfactory nerve – CN I

- Central axons form Olfactory nerve, which pass through the cribriform plate to the olfactory bulb which is in the anterior cranial fossa



Disturbances of smell

- Anosmia

- complete loss of sense of smell

- must be bilateral before noted

- often described as loss of 'taste'

Disturbances of smell

- Hyposmia

- partial loss of sense of smell

- may be qualitative or quantitative

- causes: obstruction

- rhinitis

- neuritis

- trauma

- intracranial lesions

Disturbances of smell

- Hyposmia

- causes: obstruction

- nasal polyps

- enlarged turbinates

- severe septal deviations

- common cold – oedema - temporary

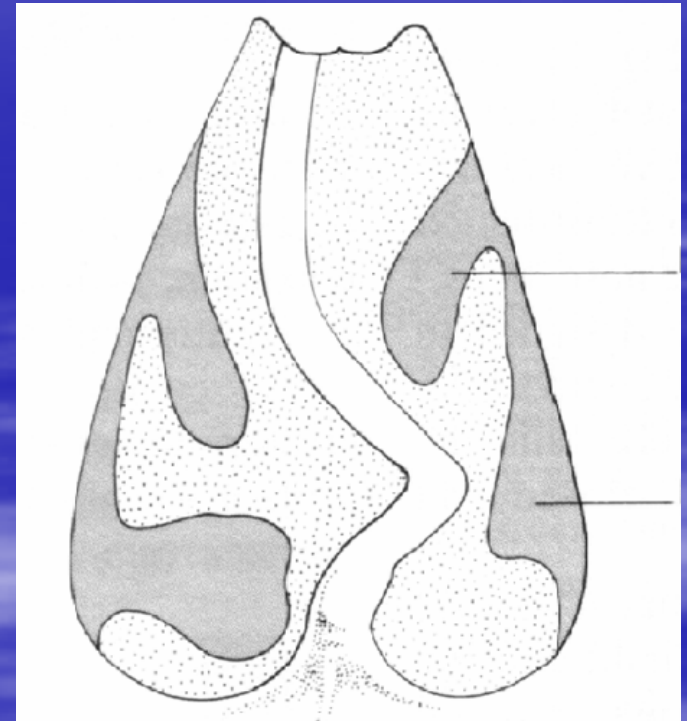
Obstruction - polyps



Obstruction - turbinate



Obstruction – septal deviation



Disturbances of smell

- Hyposmia

- causes: rhinitis

- 'vasomotor rhinitis' - damaged olfactory fibres

- atrophic rhinitis - degeneration of mucosa

Disturbances of smell

- Hyposmia

- causes: neuritis

peripheral rhinitis after 'flu
usually permanent

Disturbances of smell

- Hyposmia

- causes: trauma

- skull base fractures involving
anterior cranial fossa

- tearing of olfactory filaments

Disturbances of smell

- Hyposmia

- causes: intracranial lesions

- abscesses

- tumours

- meningitis

- ... compression of
olfactory tracts

Disturbances of smell

- Cacosmia

- perception of a bad smell

maxillary sinusitis – dental origin

foreign body in the nose

foetid pus in chronic otitis media

Disturbances of smell

- Parosmia

- perversion of smell
- subjective sensation of non-existent smell

functional / psychogenic

- organic
- influenza neuritis
 - epileptic aura
 - temporal lobe lesions
 - drugs (e.g. streptomycin)

Tests of smell

- tests of smell are medicolegally important
- being subjective, tests are difficult to interpret

Tests of smell

- Test solutions:

- lemon
- peppermint
- cloves
- rose water
- coffee
- coal tar

“smell bottles” of
fresh solutions

- Ammonia (stimulates CN V)

used if psychogenic cause suspected

- Scratch cards – emit odour when scratched – commercially available

Tests of smell

- being subjective, tests are difficult to interpret

'olfactory spectrometry' &

'cortical evoked response olfactometry'

- to quantify smell

... are being developed but as yet
not clinically practical

Conclusion

- Human sense of smell is poorly developed compared to most mammals and insects but is very sensitive in the human and almost indispensable for the individual
- Taste buds only recognize sweet, sour, salt & bitter – all other sensory impressions caused by food (e.g. aroma & bouquet) are mediated by olfaction

- Smell can *stimulate* appetite and also *depress* it
- Smell is more sensitive in state of hunger
- Smell provides warning of rotten food, poisonous & toxic substances (e.g. gas)
- Good sense of smell is important for chefs, wine, coffee & tea merchants, perfumers and chemists and the physician often needs a good 'nose' to aid diagnosis

Finally ...

- The sense of smell demonstrates the phenomenon of *adaptation* ...

... those of you who have shared a room with a group of adolescent boys will know how useful this is to cope with their apparently constant flatulence!

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