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 ⅔ tongue
Taste

- **Nerve supply**
  - lingual nerve \((\sim V_3)\)

  runs with chorda tympani
  and supplies anterior tongue
Taste

- **Nerve supply**
  - Glossopharyngeal (IX)
  - posterior ⅓ 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 ⅓ of the nasal septum,
  - roof of the nose and
  - lateral wall,

...above and including superior turbinate
Smell - anatomy

Cribriform plate
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

- Ammonia (stimulates CN V)

  used if psychogenic cause suspected

- Scratch cards – emit odour when scratched – commercially available

“smell bottles” of fresh solutions
Tests of smell

- being subjective, tests are difficult to interpret

‘olfactory spectometry’ &
’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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