Chapter 21: The Special Senses

Olfaction (Smell)

- Chemical sense

- Humans can recognize more than 10,000 odors due to 10-100 million receptors

- Sensory receptors are located in the olfactory epithelium (Total SA @ 5 cm$^2$)
Gustation (Taste)

- Chemical sense
- Five primary tastes
  - Sweet
  - Sour
  - Bitter
  - Salty
  - Umami (savory)
Gustatory Pathway

- 1st order neurons extend through cranial nerves to the medulla oblongata
- 2nd order neurons extend to thalamus
- 3rd order neurons extend to primary gustatory area in parietal lobe

Fig. 21.2

Vision

Accessory Structures of the Eye

- Eyebrows/eyelashes
- Palpebrae
- Palpebral fissure
- Lacrimal caruncle
- Conjunctiva
- Palpebral bulbar
Conjunctivitis

Internal Eye Anatomy

Tarsal plates
Meibomian glands

Fig. 21.3

Chalazion

Lacral Apparatus

Lacrimal glands
Lacrimal ducts
Lacrimal puncta
Lacrimal canals
Lacrimal sac
Nasolacrimal duct

Lacrimal fluid (tears) is water, salts, mucus, and lysozyme. What is its function?
The Eyeball Wall – Fibrous Tunic

- Sclera
  - Shape to eyeball
  - Protection
  - Extrinsic muscle attachment
  - White of eye
- Cornea

The Eyeball Wall – Vascular Tunic

- Choroid
  - Heavily pigmented
  - Well vascularized
- Ciliary body
  - Ciliary processes
  - Ciliary muscle
- Iris
  - Smooth muscle

Light Refraction
Iris

Pupil constricts as circular muscles of iris contract (parasympathetic)

Pupil

Pupil dilates as radial muscles of iris contract (sympathetic)

Bright light
Normal light
Dim light

Fig. 21.5
Anterior views

The Eyeball Wall – Nervous Tunic

• Retina
• Pigmented & neural layers

Fig. 21.4

Retina – Pigmented & Sensory Layers

Fig. 21.7
Fig. 21.7
(c) Histology of a portion of the retina

Absorption spectra for photoreceptors
The Eyeball Wall - Retina

- Optic disc
- Macula lutea
- Fovea centralis
  - Highest visual acuity

Macular Degeneration

- Detachment of retina occurs due to accumulation of debris or outgrowth of blood vessels from choroid
- Degeneration of pigmented layer
Aqueous Humor (pathway)

- Ciliary processes
- Posterior chamber
- Between iris and lens
- Through pupil
- Anterior chamber
- Scleral venous sinuses
- Blood

- Replaced every 90 min.

Glaucoma

- Glaucoma results when intraocular pressure increases (usually due to a build-up of aqueous humor).
Processing of visual input in the retina

Hearing
External Ear

- Auricle
- External Aud. Canal
- Ceruminous glands
- Tympanic membrane

Fig. 21.10

External Ear

Fig. 21.11
Tympanotomy & Tympanostomy

A small incision is made in the tympanic membrane

Tube inserted to drain fluid

Inner Ear (Labyrinth)

Bony
- Semicirc. Canals
- Vestibule
- Cochlea

Membranous
- Semicirc. Ducts
- Utricle, saccule
- Cochlear duct

Fig. 21.11

Fig. 21.13
Conduction Deafness

- Problem conducting sound waves through outer or middle ear to cochlea
- Build-up of ear wax
- Otitis media
- Tympanic membrane perforation

Sensorineural Deafness

- Problem with hair cells, vestibulocochlear nerve, auditory processing centers
- Loop diuretics, aspirin
- Genetics
- Repeated exposure to loud noises
Equilibrium

Static equilibrium – maintenance of body position (head) relative to the force of gravity
- Movements that stimulate the receptors include tilting the head and linear acceleration or deceleration
- Receptors are located in the utricle and saccule
Equilibrium

Dynamic equilibrium – maintenance of body position in response to rotational acceleration or deceleration

- Receptors are located in the semicircular ducts