ANATOMY AND PHYSIOLOGY OF THE EYE
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FUNCTION OF THE EYE

• Vision!
• Acknowledgement of surroundings
• Communication
• Help with food acquisition (hunting)
• Navigation
• Recognition of friend and foe

VISION IN SMALL ANIMALS

• Dogs and cats are nocturnal or crepuscular
• Less detailed vision; however greater night vision
• Eyes slightly set to side to allow greater peripheral vision
• Once thought color blind; however newer thought is can see shades of colors
  • Yellows, blues, grays
• While some dog breeds and cats may be near sighted, most dogs are normal sighted
PARTS OF THE EYE

• Eyeball
• Accessory organs
  • Nerves: central and peripheral
  • Glands
  • Muscles
  • Eyelid and eyelash

EYEBALL

• Average size in dogs 2-2.2cm, cats 1-2.2cm
• 3 chambers: anterior, posterior and vitreous chambers
• 3 tunicas (coats): tunica fibrosa bulbi, tunica vasculosa bulbi and tunica interna bulbi
• Contain many different cell and fluid types
• Sensory organ that uses specialized cells to take in light to transfer to brain as images
• Recognizes color, movement and "pictures" via light

TUNICA FIBROSA BULBI

• Contains sclera and cornea
• Fibrous tissue
• Protects eye
• Refraction of light rays
SCLERA
- White part of eye
- Contains elastic and collagen fiber tissue
- Varies in thickness depending where on eye
- Protection of eye
- Insertion sight for various nerves and muscles of eye

CORNEA
- Outermost, clear protective layer in front of eyeball
- Contains epithelia, stroma, endothelial layers
- Curved and bends light to distribute to eye
- Helps with some light absorption
- Protects delicate internal eye

ANTERIOR CHAMBER
- Uvea
- Contains iris, ciliary body, iridocorneal angle
- Adjusts amount of light eye intakes and helps to recognize distance
**TUNICA VASCULOSA BULLI / UVEA**

- Contains choroid, tapetum lucidum, ciliary body, iris, and pupil
- Contains anterior and posterior chambers
- Shape of eye, light absorption and vision

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**IRIS**

- Color part of eye
- Thin, muscular diaphragm
  - Sympathetic nervous system controls dilation of pupil, parasympathetic system controls constriction
- Pupil is opening of iris
- Iris constricts and dilates to control amount of light delivered to retina

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**PUPIL**

- Hole in middle of iris
- Concentrates light to retina
- Black is retinal and choroidal pigmentation
  - Absorbs scattered light to prevent secondary absorption
PUPILLARY LIGHT REFLEX (PLR)

• Demonstrates appropriate pupil/iris response to light stimulus
• Should be consensual
• Healthy animals will dilate pupils in darker light
• Healthy animals will constrict pupils in high light
• Controlled by sympathetic and parasympathetic system, various nerves including optic nerve

MYDRIASIS VS MIOSIS VS ANISOCORIA

• Mydriasis is dilation of pupils
  • Darkness, anesthesia/sedation, blindness, neurologic disease

• Miosis is constriction of pupils
  • Bright light, neurologic disease, moribund patient

• Anisocoria is two different sized pupils
  • Neurologic disease esp head trauma, eye trauma; Horner's syndrome
anisocoria  miosis  mydriasis

CILIARY BODY
• Ring shaped muscle behind iris
• Changes shape of lens for focusing
• Produces aqueous humor

AQUEOUS HUMOR
• Produced in ciliary body
• Fills anterior and posterior chamber
• Similar to plasma, although lower amounts of proteins
• Provides shape to eyeball
• Provides nutrition to eye
• Removes waste from eye
BLOOD- OCULAR BARRIER

- Produced by endothelium of capillaries of retina, iris and ciliary body
- Prevents systemic drug absorption by the eye
- Makes medicating eyes with systemic medications difficult: most of the time ocular meds more appropriate.
- Some drugs might break down or bypass blood-ocular barrier

TUNICA INTERNA BULBI

- Contains nervous tissue and vitreous body
- Contains retina, tapetum lucidum and lens
- Receptor cells convert light and send to central nervous system
- Refraction of light

FUNDUS

- Anterior, inside part of eye
- Contains
  - Retina
  - Optic disk
  - Blood vessels
  - Tapetum
LENS
- Transparent body behind pupil
- Contain a cytoplasm filled with crystalline proteins
- Absorbs light from pupil and focuses to retina

RETINA
- Behind lens, towards back of eye
- Contains rods and cones
- Able to visualize with lights
- Absorbs and converts light to nervous impulse

RODS
- Specialized photoreceptor cells in retina
- Concentrated to outer layer of retina
- Absorb light
- Allow for peripheral vision
- Allow for night vision
- Canines and felines have more rods than humans
CONES

- Photoreceptors in retina
- Respond to various wavelengths
- Responsible for color vision
- Work best in high light areas
- Dogs have 2 types, cats 3 types

TAPETUM LUCIDUM

- Dogs and cats have
- Back of eye
- Reflective membrane
- Reflects light in very low light
- Improves night vision

CHOROID

- Located directly under retina
- Contains vasculature of eye
- Also called posterior uvea
MACULA

- Pigmented spot in eye between lens and retina
- Helps to focus light for high resolution pictures
- Only primates have
- Able to see with fundic exam

FOVEA

- Located in center of macula
- Concentration of cones
- Only primates have
- Help to see high resolution pictures

VITREOUS HUMOR

- Clear gel and liquid between lens and retina
- Center is liquid, gel around edge
- Maintains shape of eye
- Maintains attachment of retina
OPTIC NERVE

- Cranial nerve II
- Receives impulses from retina
- Transmits impulse to brain
- Brain receives impulse as image

VISION

- Light enters eye through pupil. Iris will constrict or dilate to help control amount of light
- Light goes through lens, which refracts light to retina. In low light, tapetum reflects more light to retina
- Rods use rhodopsin for light absorption; cones use photopsin for color absorption
- Creates neurotransmission through chemical reaction from rhodopsin and photopsin to optic nerve
- Neurotransmission to brain allows for brain to recognize images

CORTICAL BLINDNESS

- Blindness is from optic nerve pathology or brain disease
- Eye structures are normal
- Patient will be blind, but have normal PLR
- Blindness may be acute or chronic
OTHER MAJOR NERVES OF THE EYE

• Oculomotor nerve (cranial nerve III): movement of the eye
• Trochlear nerve (cranial nerve IV): movement of the eye
• Trigeminal nerve, ophthalmic branch (cranial nerve V): sensation to eye and orbit
• Abducent nerve (cranial nerve VI): retraction of eye
• Facial nerve (cranial nerve VII): enervation of eyelids and lacrimal ducts

MUSCLES OF THE EYE

• Intraocular muscles: sphincter muscles of the iris
• Extraocular: striated muscles
  • Dorsal, ventral, lateral rectus muscles
  • Dorsal and ventral oblique muscles
  • Retractor bulbii muscles
• Palpebral muscles: control eyelids

SKELETAL STRUCTURES OF THE EYE

• Orbit (bone cavity where eye sits)
• Zygomatic bone
• Lacrimal bone
• Maxillary bone
• Sphenoid bone
• Palatine bone
• Frontal bone
CONJUNCTIVA
- Mucous membrane surrounding eye
- Lines ocular socket and around eyeball
- Lined with stratified squamous epithelial cells
- Contains goblet cells for tear production
- Highly vascular

NICTITATING MEMBRANE
- "Third eyelid"
- Protects and moistens eye
- Not heavily muscled in dogs and cats, and often not fully visible
- Has function of cleaning and protecting eye during hunting, diving, and pecking in other species

LACRIMAL APPARATUS
- Produce tears
- Lacrimal gland: large gland
- Superficial gland of third eyelid
- Nasolacrimal duct system
LACRIMATION

• Tear production
• Produced by eye, lipid glands and lacrimal ducts
• Two types of tears
  • Basal tears: constant to keep eyes lubricated and act as barrier to cornea
  • Reflex tears: produced when irritant contacts eye
    • Large amounts produced at once
    • Contains more antibodies

TEARS

• Lubricate eye
• Three layers
  • Inner mucous layer
  • Watery middle layer
  • Outer oily layer

REFLEXES

• Pupillary light reflex: reaction to light. Iris will constrict pupil to reduce amount of light
• Palpebral reflex: blink response to tactile stimulation to cornea or skin around eye
• Menace reflex: response to movement at face; tests cortical response
• Dazzle reflex: aversion to strong light; retina and cortical response
THANK YOU!!!