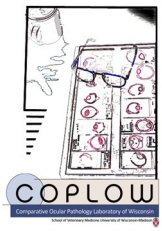
AAPSP Australian Animal Pathology Standards Program

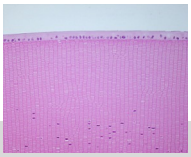
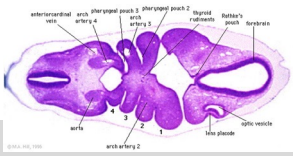
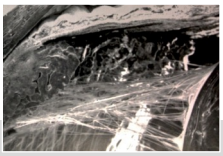
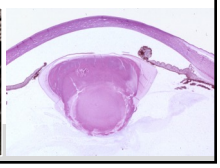
Davis-Thompson Foundation

School of Veterinary Medicine

Veterinary Pathology Roadshow 2026



7. Pathology of the Lens

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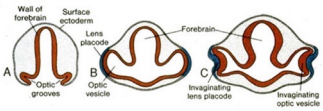
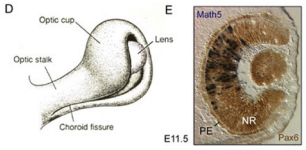
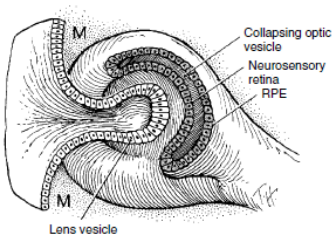
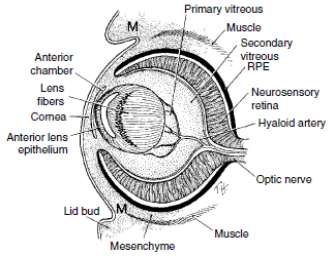
Lens Development

- The induction of the lens placode
- Involution of the lens placode
- Elongation of the posterior lens epithelial cells
- Formation of the cortex
- The tunica vascularis lentis









Gelatt's Veterinary Ophthalmology, 6th Ed.

2

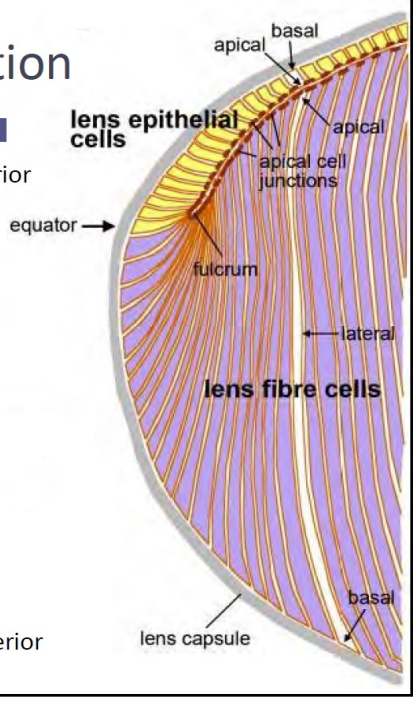
Lens Fibre Differentiation

- cellular polarity is maintained during differentiation

anterior

equator

posterior



Lens capsule surrounds the lens prior to the immune system being competent Exposure to the lens proteins result in inflammatory response

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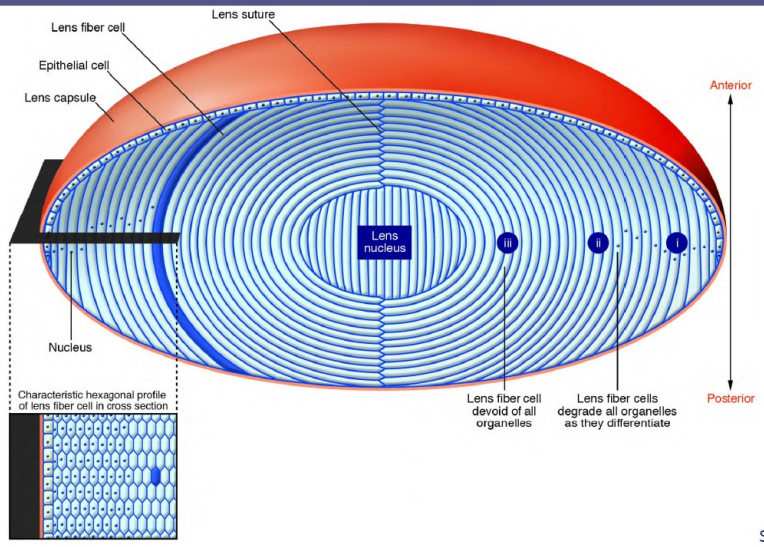
Lens Fibre Differentiation



Song, 2009

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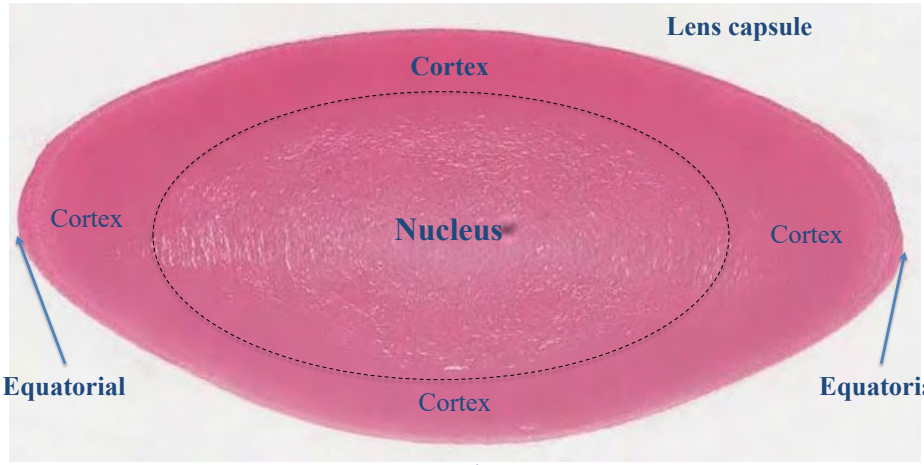
Normal histology



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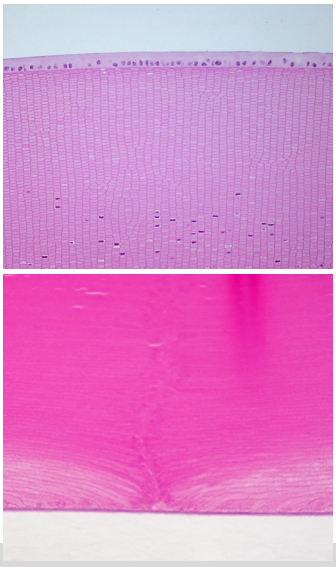
Normal Lens Anatomy

- Lens Capsule
  - Basement membrane of lens epithelium
  - Elastic properties
- Lens Epithelial Cells
  - Proliferation zone
- Nuclear Bow
  - Elongation and turning of LEC
- Lens Fibers
- Lens Sutures
- Anatomic Variations
  - Annular pad
  - The spherical lens



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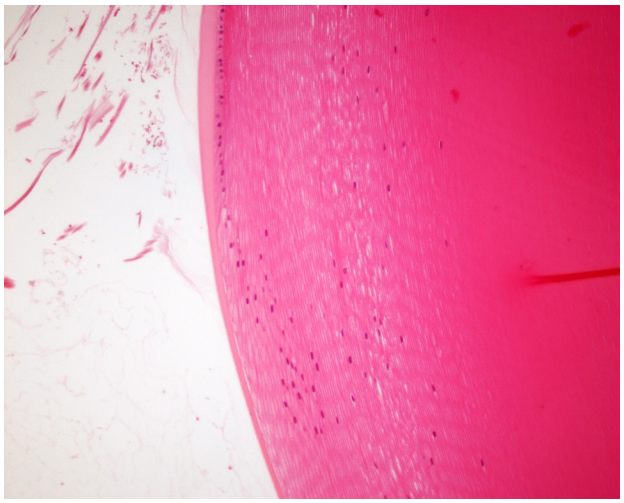
Normal Lens Morphology



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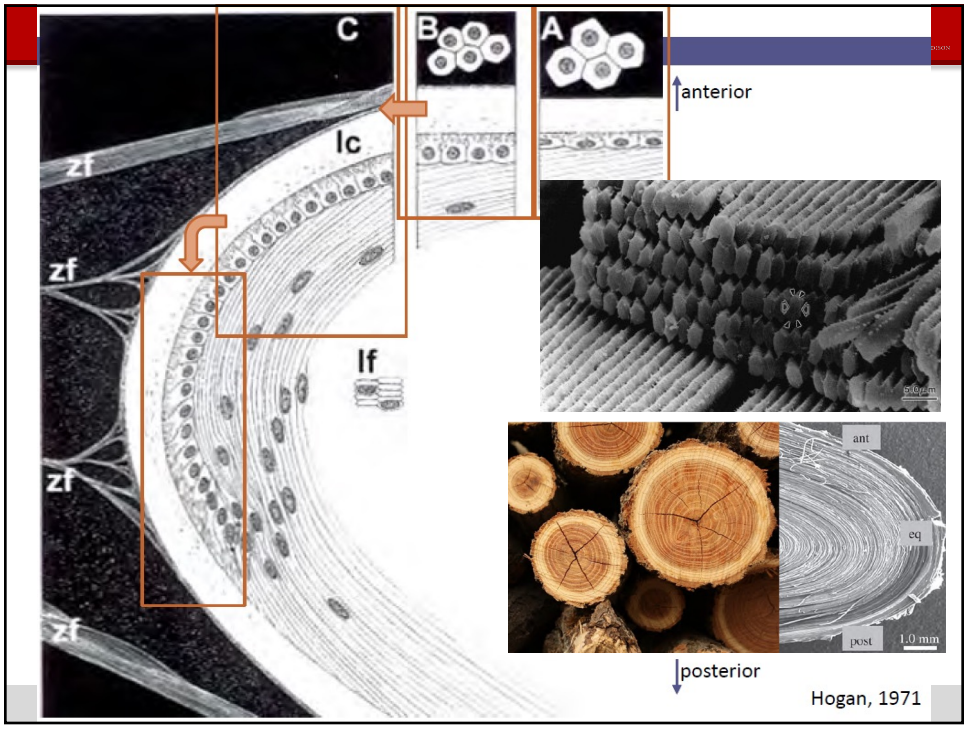

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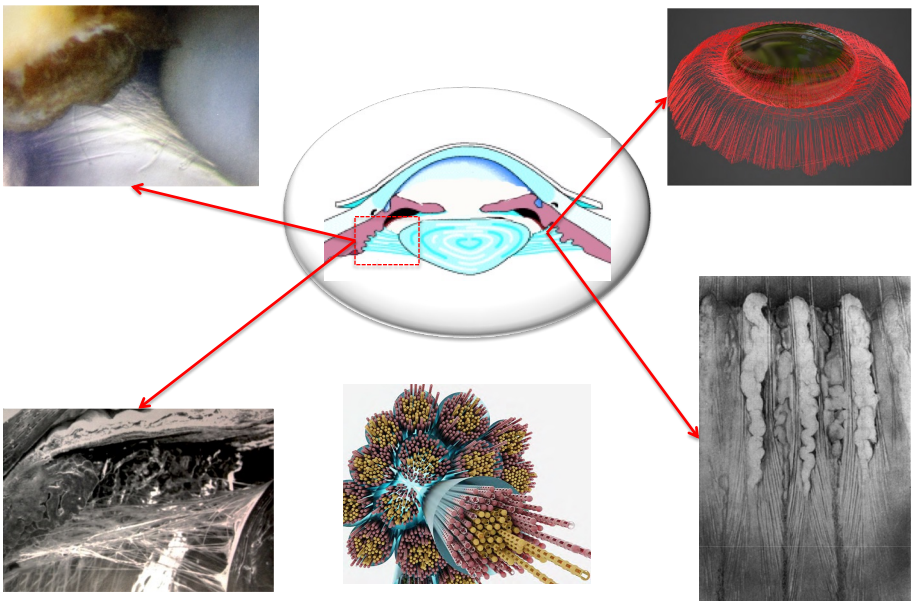
Histology zonular ligaments



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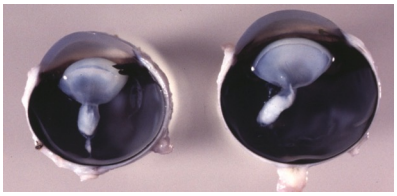
Congenital Abnormalities

- Aphakia
- Microphakia
- Spherophakia
- Lens coloboma
- Lenticonus/lentiglobus

Microphakia with spherophakia



Lenticonus

Lens coloboma

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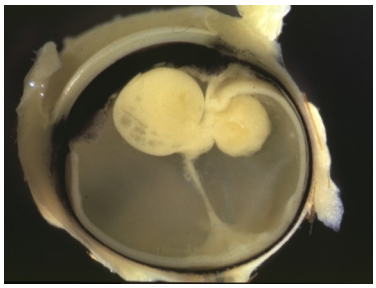
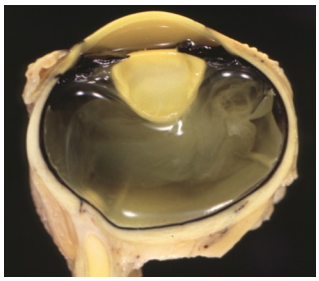
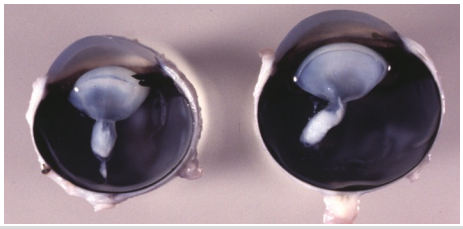
Abnormal Lens Shape - Lenticonus



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Cataract

Definition

Any reduction in the optical clarity of the lens with or without reduction of vision.

- Clinical diagnosis
- Pathologist's perspective
  - Macroscopic diagnosis
  - Morphologic diagnosis: Lens fiber degeneration

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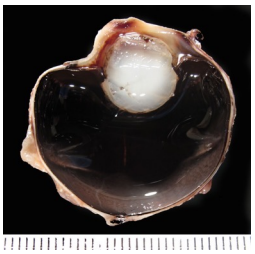
Cataract

Causes



- Advanced age
- Hereditary
- Trauma
- Diet
- Diabetes & other metabolic disorders
- Vitreous disorders
- Retinal disorders
- Inflammation
- Toxic

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Cataract

Pathogenesis

- Previously clear lens fibers become opaque
  - Osmotic changes
  - Contusion or trauma disrupting lens fibers
- Formation of new opaque lens fibers
  - Congenital cataract
  - Toxic or radiation cataract where LEC is damaged
- Fibrous metaplasia (subcapsular cataract)
- Mineralization

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Cataract

Classification

- Poor clinicopathological correlation!
- Multiple ways to classify
  - **Etiology:** Metabolic, secondary, traumatic…
  - **Age of onset:** congenital, juvenile, senile…
  - **Anatomical location:**
    - Capsular, subcapsular, anterior, posterior, equatorial, cortical, nuclear…
  - **Stage of progression:**
    - Incipient (<15%), Immature (.15%), Mature (circumferential), Hypermature (Lens collapse / resorption)

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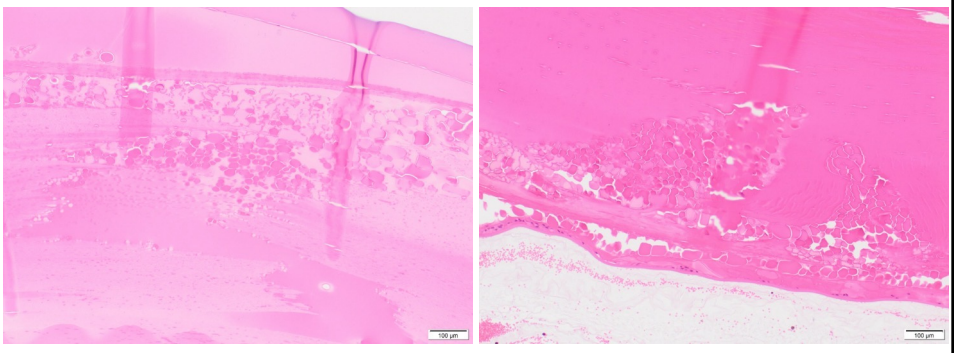
Morgagnian globules



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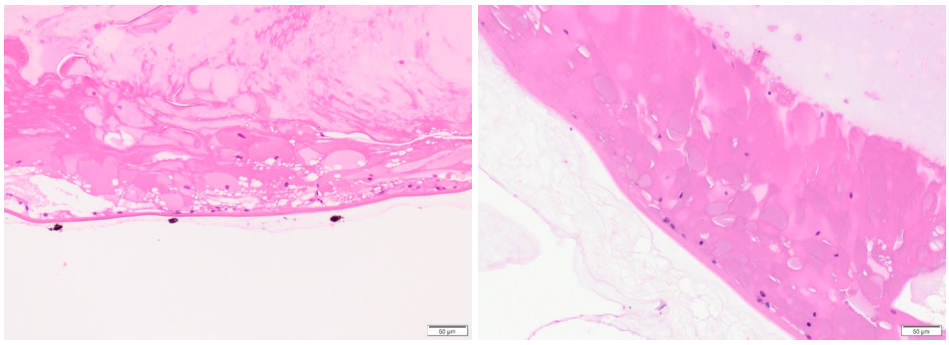
Bladder (Wedl) cells



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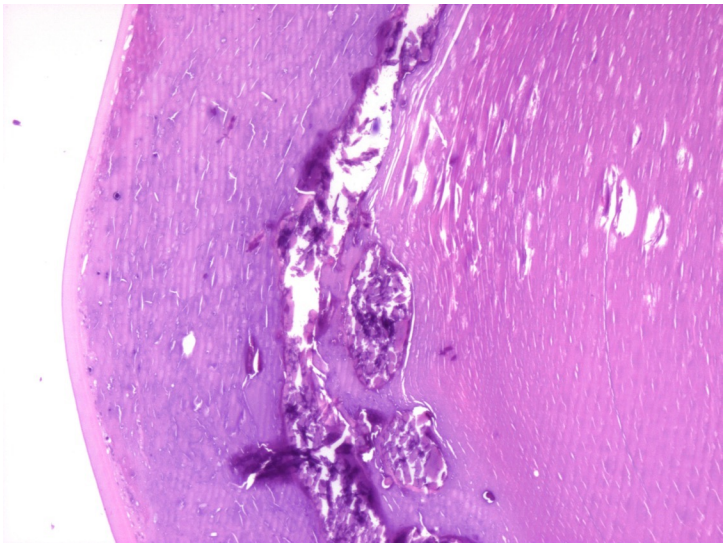
Mineralization



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Cataract Morphologic Types

- Congenital cataract
- Subcapsular cataract
  - Anterior and posterior
- Cortical cataract
  - Early, Mature, Intumescent or Hypermature
- Morgagnian cataract

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Congenital cataract

- Abnormal position or lysis of the nucleus
- Dysplastic changes in the lens capsule
  - Duplication, wrinkling
- Posterior migration of lens epithelium
- Fetal vasculature anomalies

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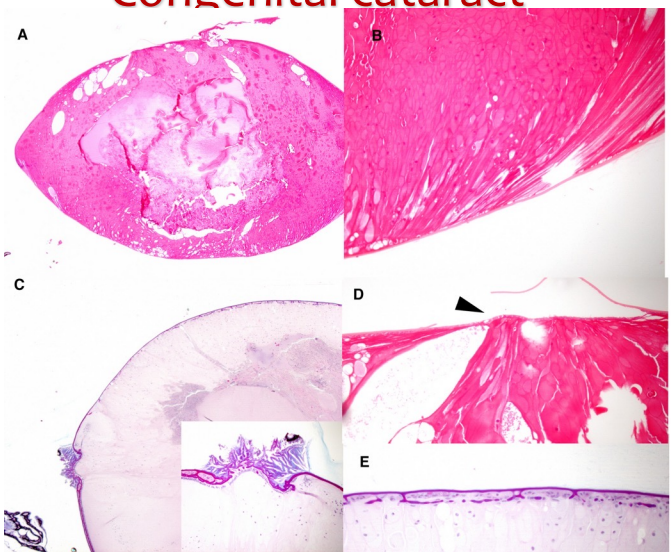
Congenital cataract



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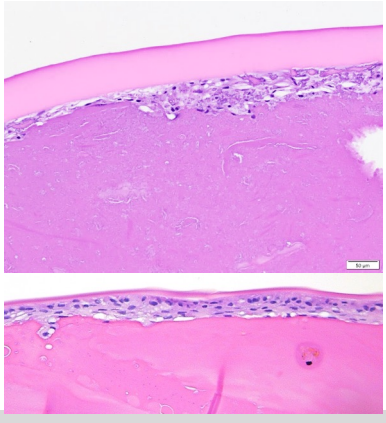
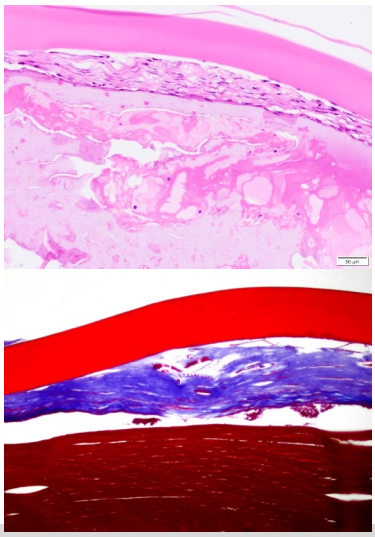
Cataract

- **Subcapsular – anterior**:
  - LEC proliferation and fibrous metaplasia
  - Collagenous mb





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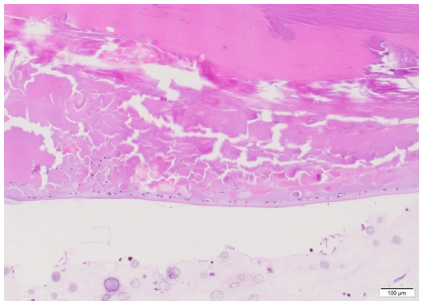
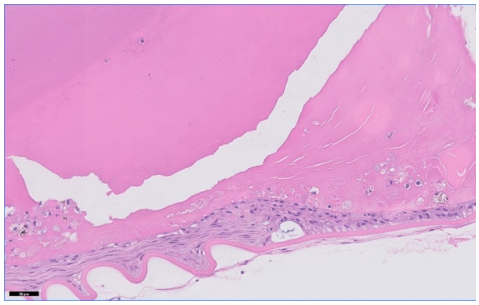
Cataract

- **Subcapsular – posterior**:
  - Migration of lens epithelium
  - Proliferation, fibrous metaplasia, collagen membranes

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Cataract

- **Cortical**:
  - Early/incipient: not always detected (2D vs 3D)
  - Mature:
    - Bladder cells
    - Morgagnian globules
  - Intumescent:
    - Lens swelling
    - Morgagnian globules throughout the cortex

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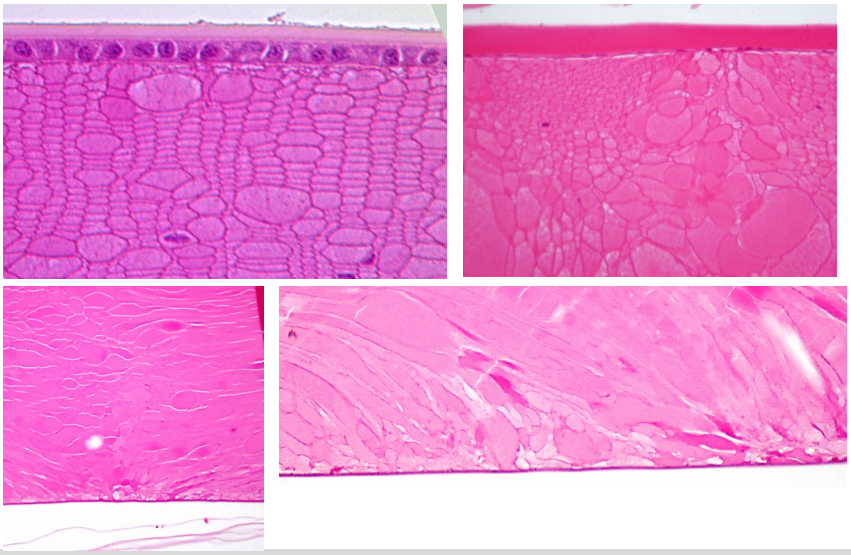
Early Cortical Cataract



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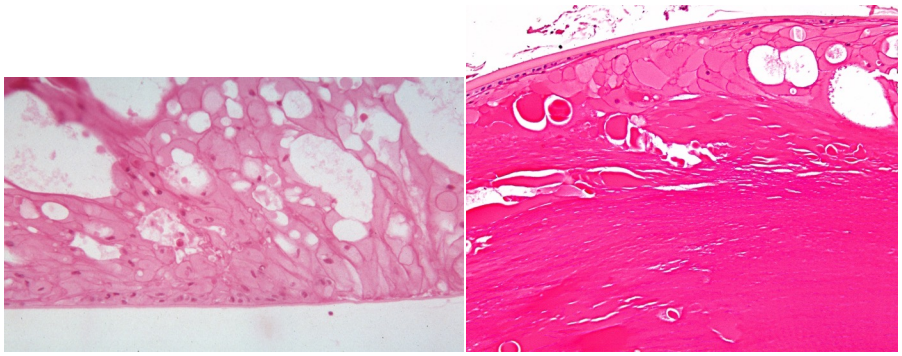
Mature Cortical Cataract



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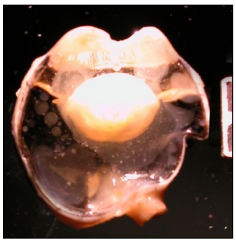
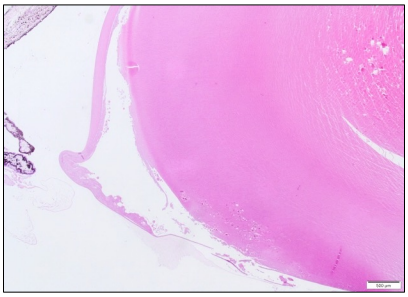
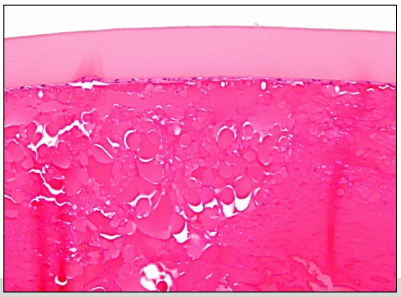
Intumescent cataract







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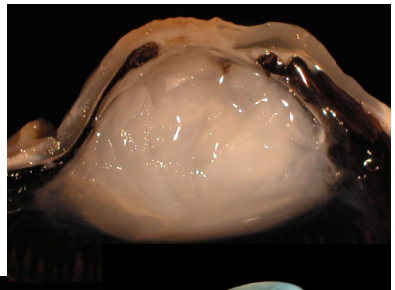
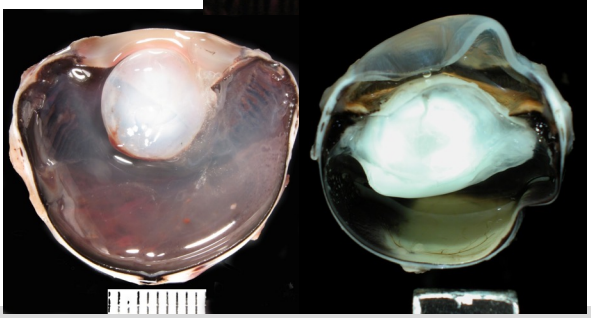
Hypermature Cataract

- Degeneration and liquefaction of lens fibers
- Mineralization
- Lens capsule wrinkling
- Collapse of lens architecture





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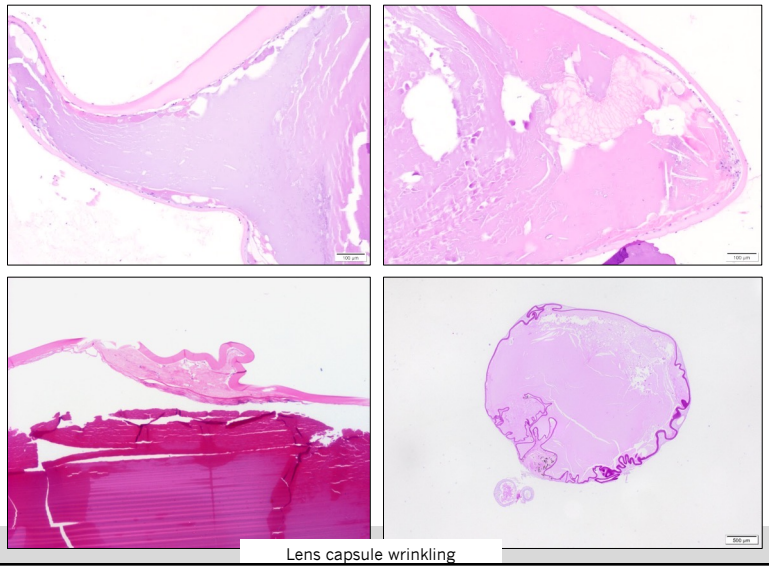
Hypermature Cataract

Cortical liquefaction



Lens capsule wrinkling

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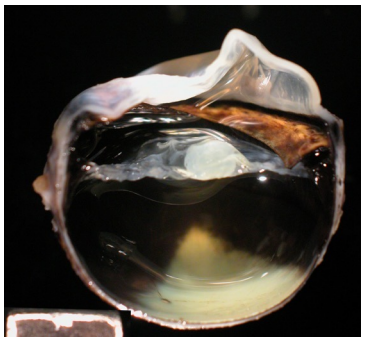
Morgagnian cataract

Complete cortex liquefaction,
only the nucleus remains



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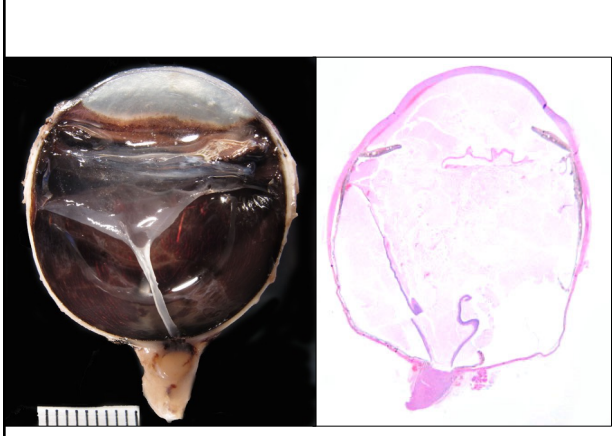
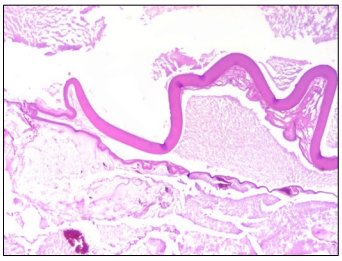
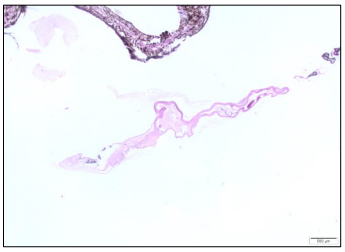
Resorbed cataract







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Consequences of trauma on the lens

- Cataract
- Lens luxation
- Lens epithelial proliferation
- Feline Post-traumatic sarcoma

See ocular trauma lecture for more details

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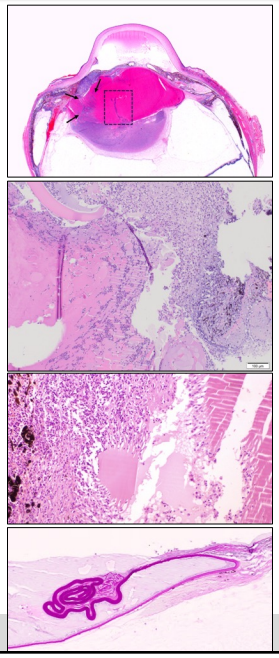
Cataract after trauma

- Anterior or posterior subcapsular / cortical
- Lens capsule rupture:
  - Intralenticular cells:
    - MO, PMNn, RBC, fibroblasts, blood vessels
  - Margins of the lens capsule:
    - Proliferating LEC entrapping the edges of the capsule
    - Spindle cells associated with synechiae
    - Frayed capsule edges with inflammatory cells.
  - Scrolling of the edges of lens capsule



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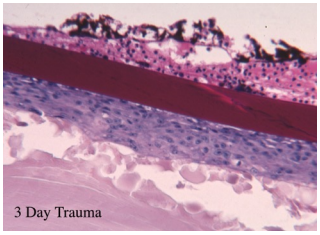
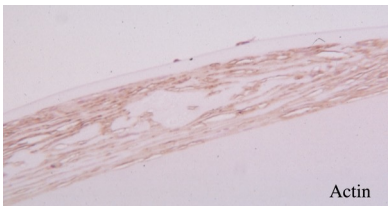
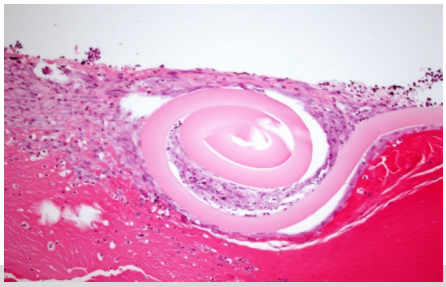
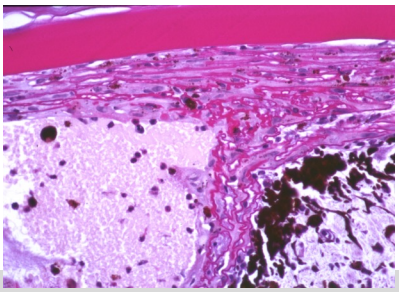
Lens epithelial cell metaplasia, proliferation, and migration following trauma









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Lens Luxation

- Separation of lens from the zonular attachment
  - Subluxation
  - Anterior luxation
  - Posterior luxation

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Lens luxation

- Primary:
  - **Zonular ligament dysplasia**
  - Marfan syndrome
- Secondary:
  - Trauma
  - Glaucoma (buphthalmos)
  - Hypermature cataract
  - Uveitis
  - Senile

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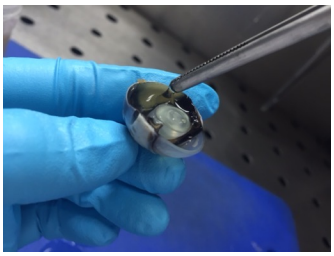
Diagnosing lens luxation

1. Clinical diagnosis
2. Grossly (trimming)
3. Lens displacement
4. Vitreous liquefaction
5. Distorted angle of the iris leaflet ("dogleg")
6. Attenuation of the corneal endothelium (axially)
7. Atrophy of ciliary processes
8. Position of the lens on the histo slide (least reliable)



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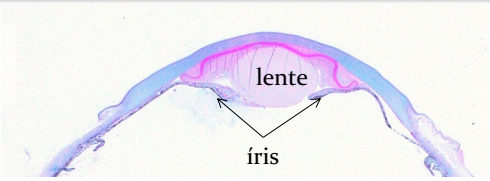
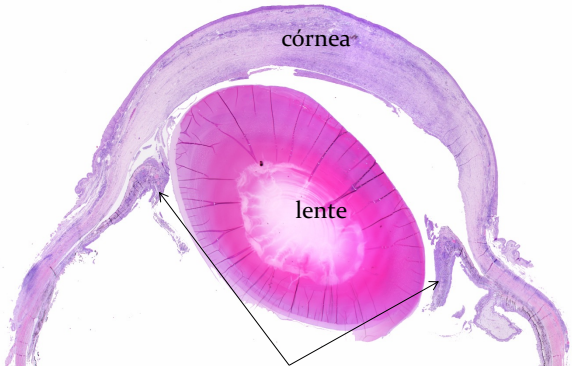
Lens luxation





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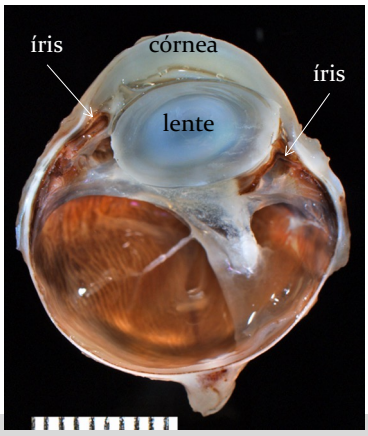

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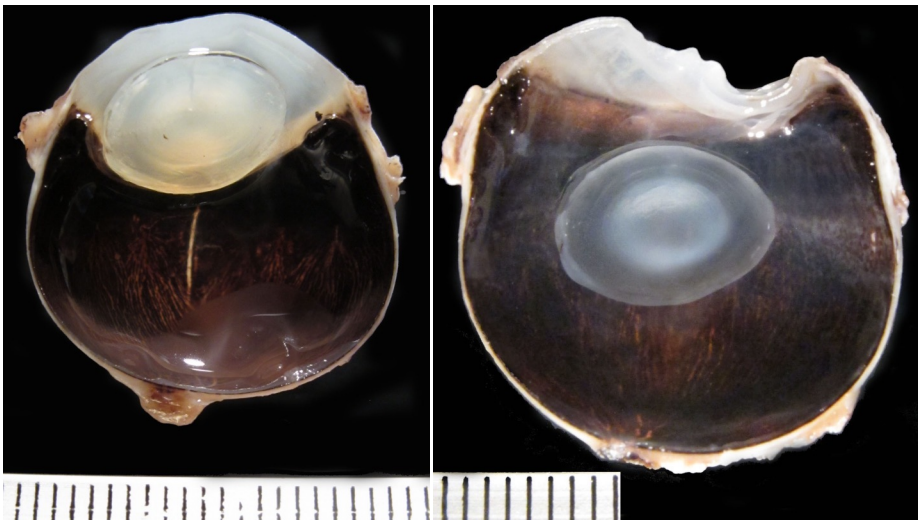

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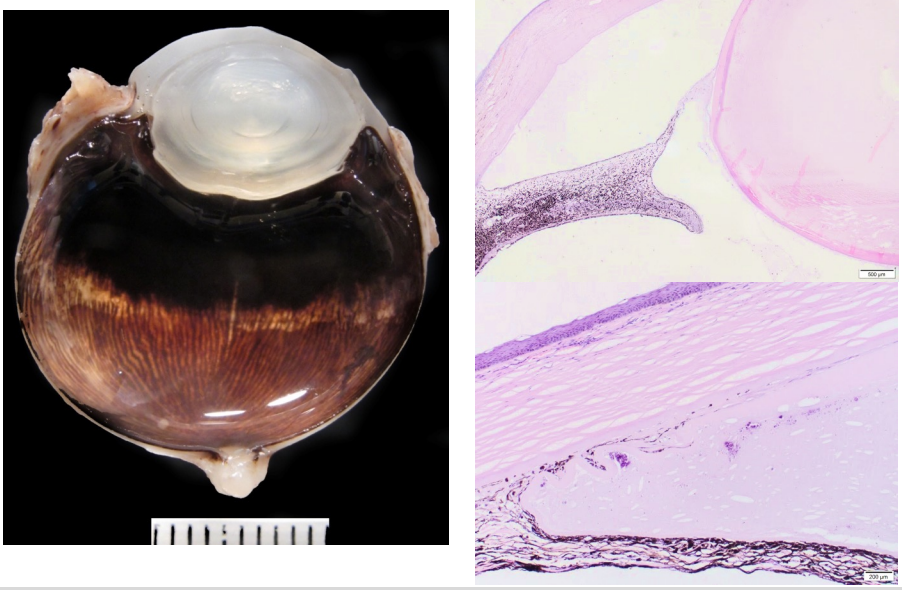

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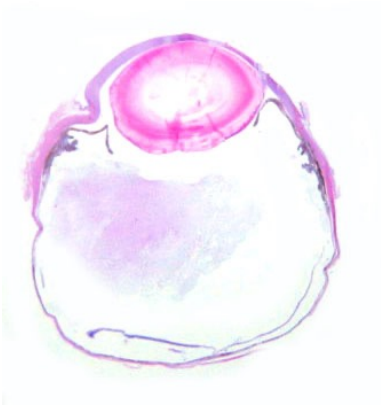
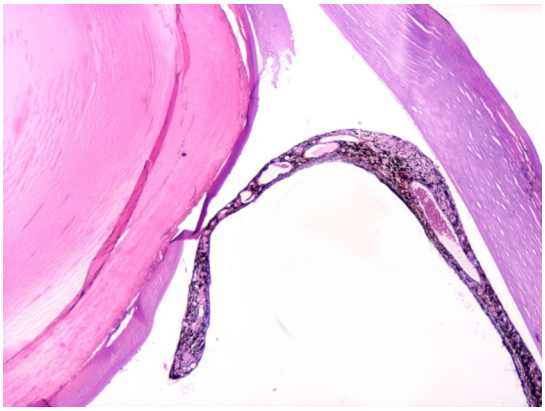
Entrapment of the lens





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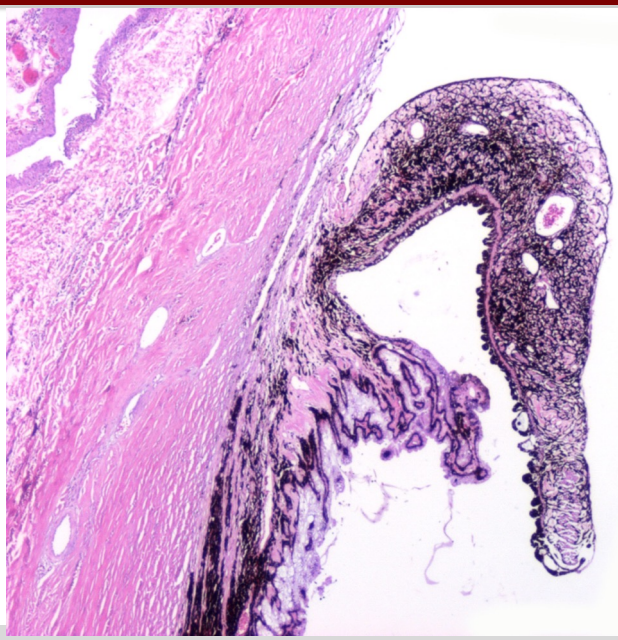

"Dog leg" iris

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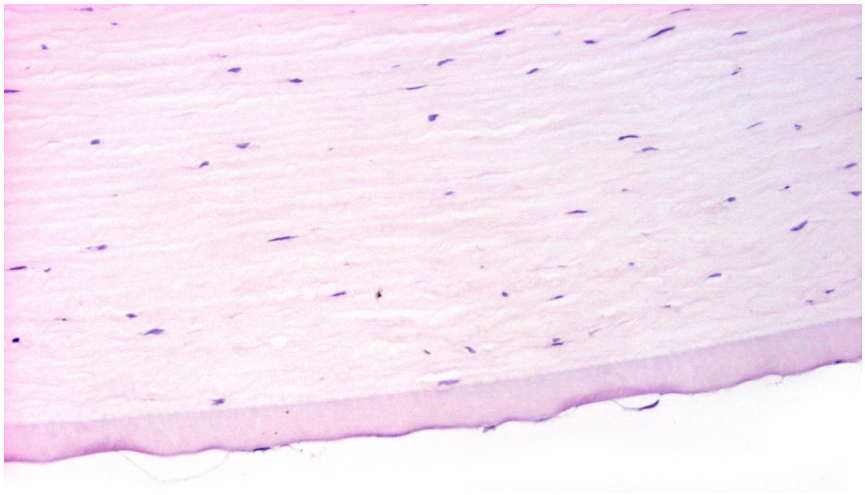
Endothelial cell attenuation



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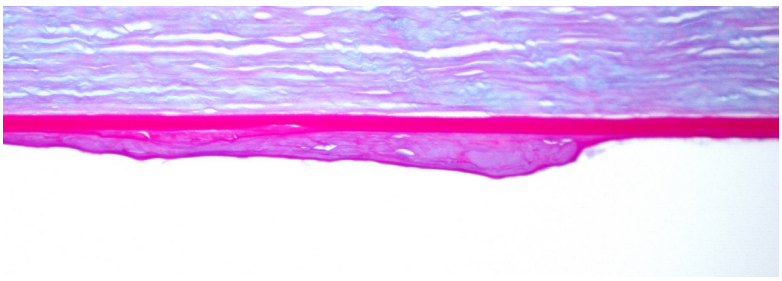
Consequences of lens luxation

- Glaucoma
- Vitreous degeneration
- Corneal endothelial atrophy
- Retrocorneal membrane formation



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Primary lens luxation of Terrier dogs
Zonular ligament dysplasia

Veterinary Ophthalmology (2005) **8**, 2, 81–84

Light-microscopy evaluation of zonular fiber morphology in dogs with glaucoma: secondary to lens displacement

Rebecca A. Morris and Richard R. Dubielzig
School of Veterinary Medicine, Comparative Ocular Pathology Laboratory of Wisconsin University of Wisconsin, 2015 Linden Drive, Madison, WI 53706, USA

- Terrier breeds (JRT)
  - Chinese crested, Shar Pei, Australian blue Heeler, Chihuahua, etc…
- Many breeds w/ ADAMTS17 mutation
- Younger than other dogs with lens lux
- Important for the 2nd eye!
- Described in cats (SCOP 2022/2024)

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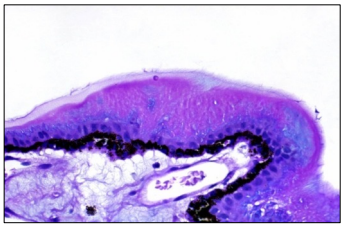
Zonular ligament dysplasia

- Thick lamellar eosinophilic membrane w/ cross-hatching pattern
- Intermittent change
- Staining properties;
  - PAS-positive (normal also +)
  - Blue with Masson's trichrome (normal is red)
  - Negative for Verhoeff's elastin stain (normal is +)



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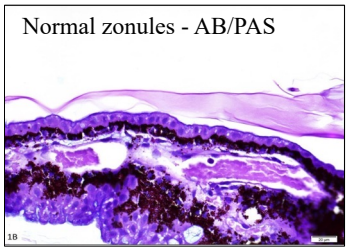
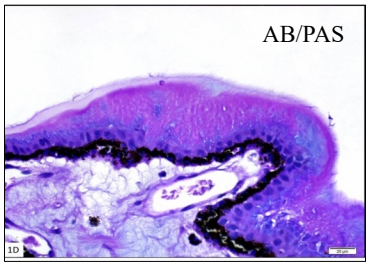
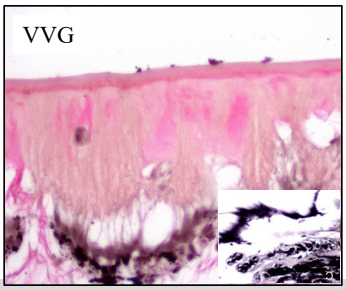
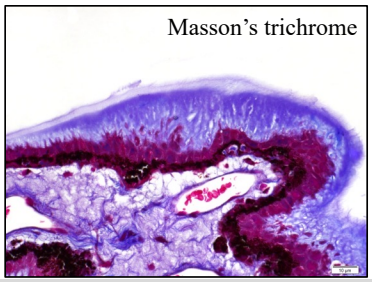
Zonular ligament dysplasia









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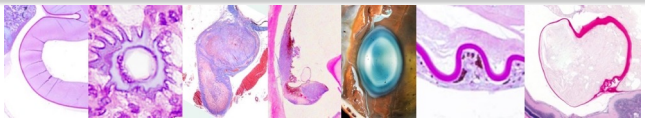
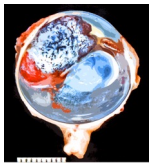
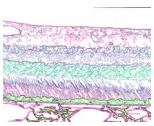
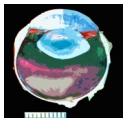
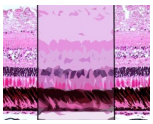


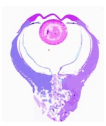
Questions?

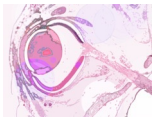












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