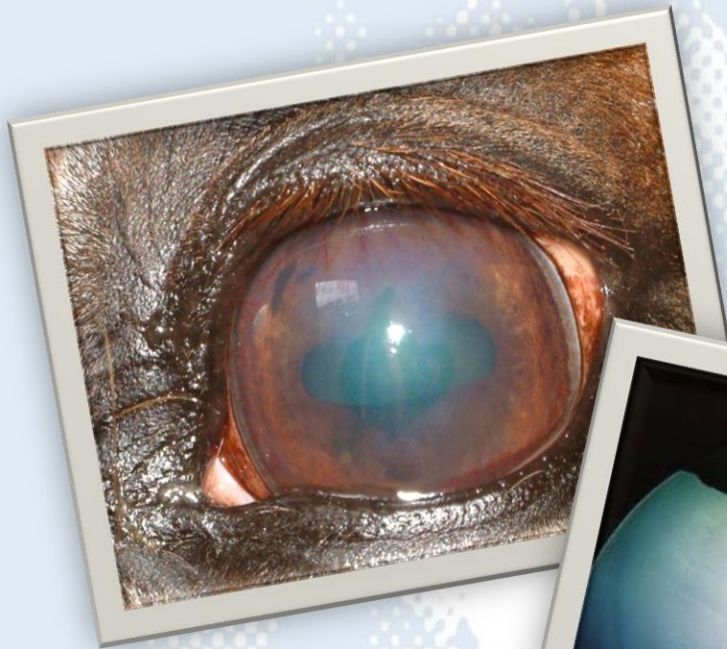


# Common Equine Ophthalmic Conditions

Tim Knott [www.EquineEyeClinic.co.uk](http://www.EquineEyeClinic.co.uk)






# International Equine Ophthalmology Consortium

- Home
- Locate a Member
- Membership
- Resources
- Education

## Edinburgh, Scotland, EU - 2023

 **2023 IEOC Equine Ophthalmology Symposium**  
**Edinburgh, Scotland**  
**June 1-3, 2023**



# Common Equine Ophthalmic Conditions



## Corneal disease:

- *repair mechanisms*
- *non-healing ulcers*
- *presumed immune disease*



## Uveitis



## Cataract

Normal repair mechanisms & chronic corneal disease

# EQUINE CORNEAL DISEASE



# Tip 1: Things to Remember in Corneal Diseases



Ulcer no change > 3 days = complicated

Cellular infiltrate = corneal cytology

Progressive or pending perf = surgical dz

Descemetocelles are surgical emergencies

Once eyes are perforated the prognosis decreases

Tip 2: understand how the cornea is put together .....

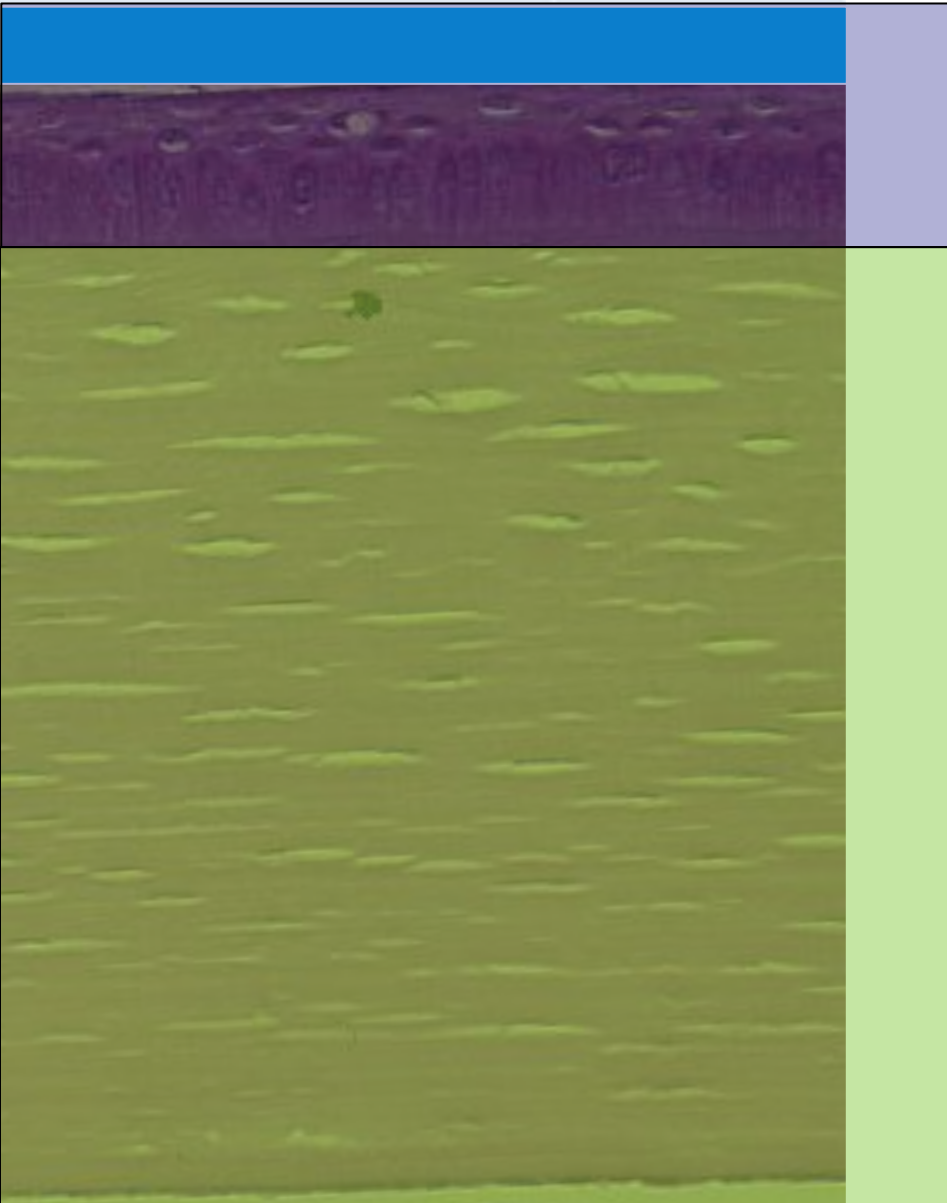
# Corneal anatomy



# Corneal anatomy



# Corneal anatomy



**Anterior cornea:**  
tear film, epithelium &  
basement membrane

**Posterior cornea:**  
Stroma  
Descemet's membrane  
Endothelium

# Tear film anatomy

- Trilaminar structure:
  - Lipid (meibomian glands)
  - Aqueous (temporal and third eye lid gland ductules)
  - Mucins (conjunctiva ventral fornix)
- Plus:
  - Lactoferrin
  - IgA (increases when lids closed)
  - Lysozyme
  - **MMPS**

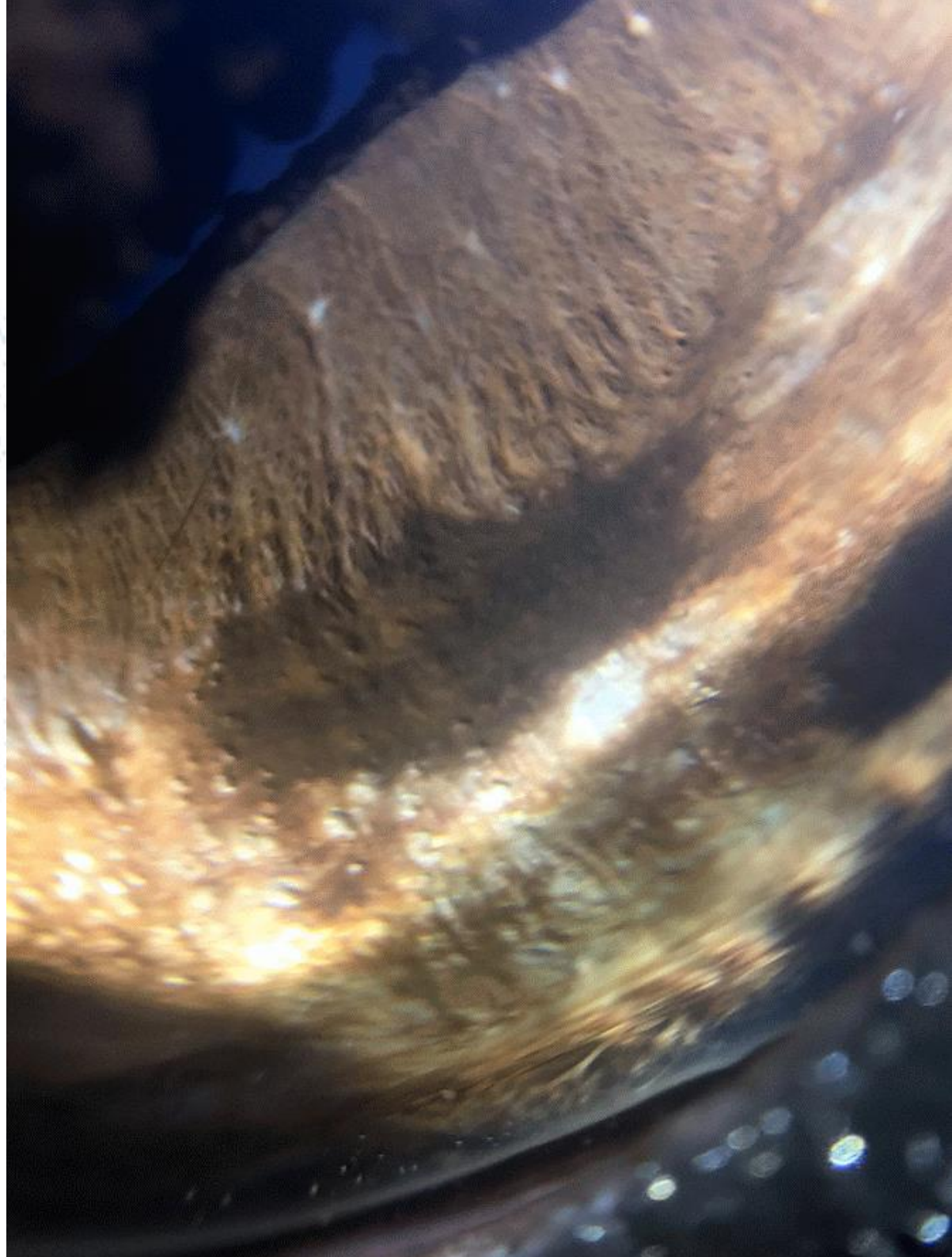




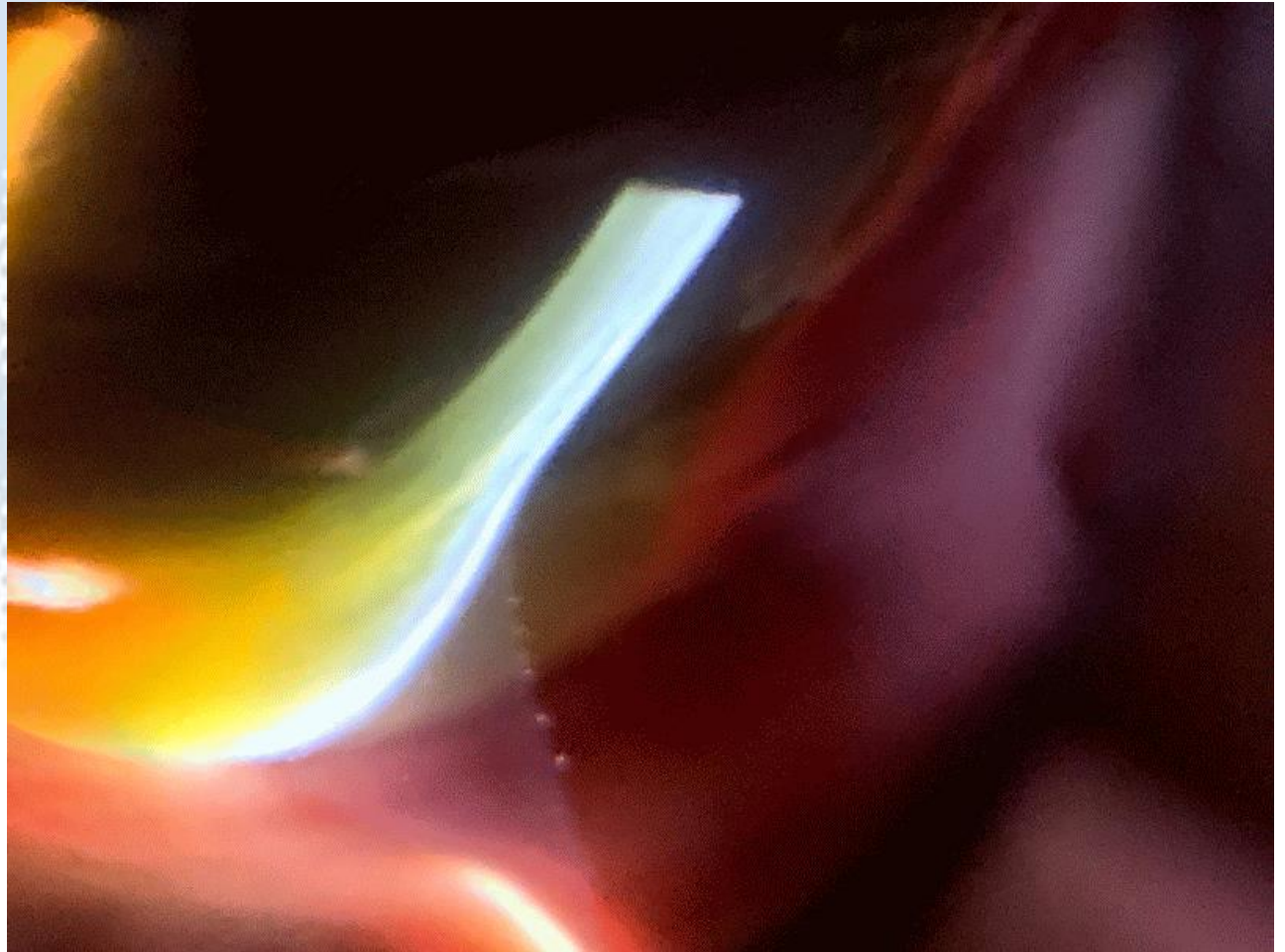
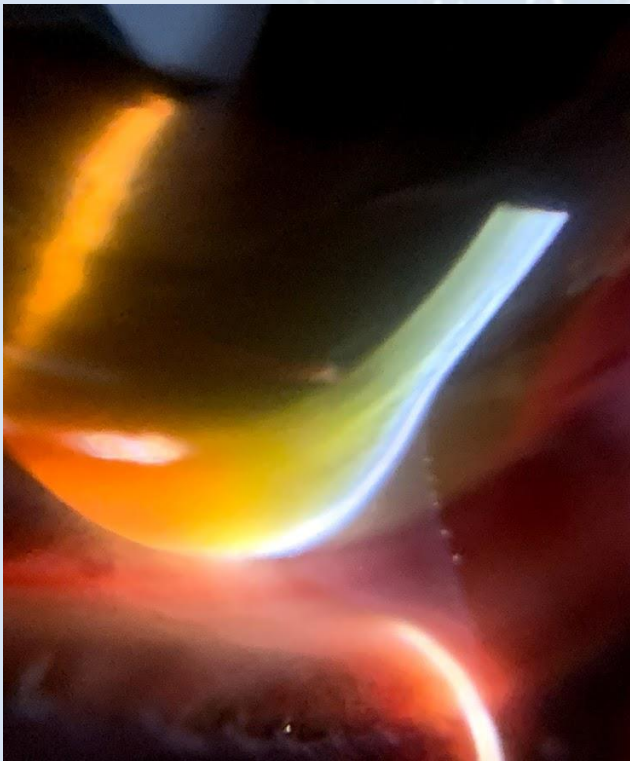
# Lacrimal lake

*Note focal iridal  
pigmentary lesion.*

*iPhone 6, macro lens, oblique  
lighting, stacked macro images.*



The Lacrimal lake – slit lamp appearance



- **GIFs**  
Apple iPhone XS Max
- f/1.8 1/33 4.25mmISO400

# Differentiating anterior from posterior corneal disease

## Anterior cornea

### Is it reflective?

- Smooth surface which means....
- Healthy tear film
  - Lipid phase
  - Aqueous phase
  - Mucin
- Intact epithelium – rapid turnover

## Posterior cornea

### Is it transparent?

- Regular arrangement stromal fibres – slow turnover, relative dehydration
- Absence blood vessels, simple cellular structure
- Relative dehydration - functional endothelium
- Transparent endothelium



# Differentiating anterior from posterior corneal disease

## Anterior cornea

### Is it reflective?

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- Healthy tear film
  - Lipid phase
  - Aqueous phase
  - Mucin
- Intact epithelium – rapid turnover

## Posterior cornea

### Is it transparent?

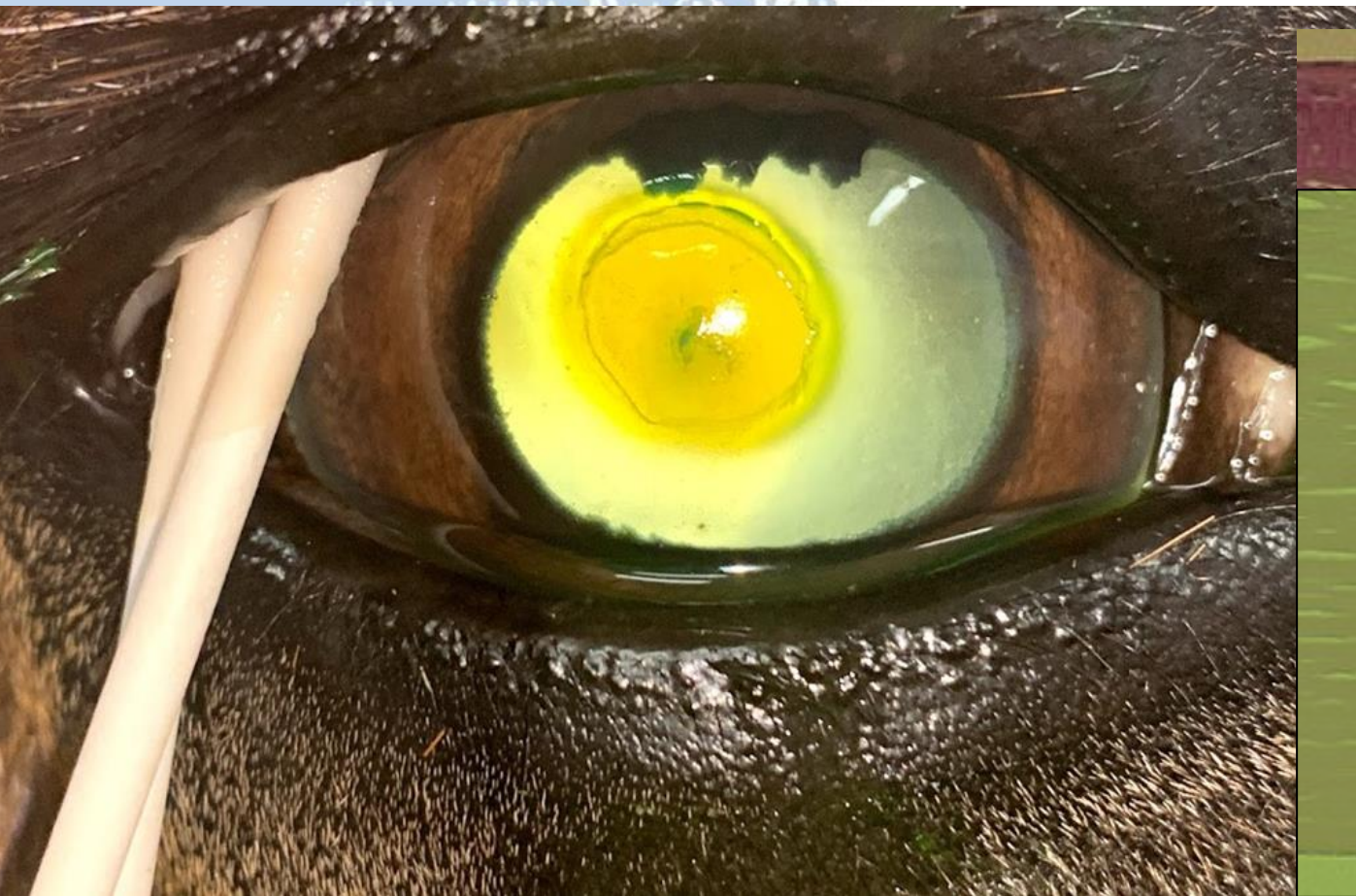
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- Absence blood vessels, simple cellular structure
- Relative dehydration - functional endothelium
- Transparent endothelium



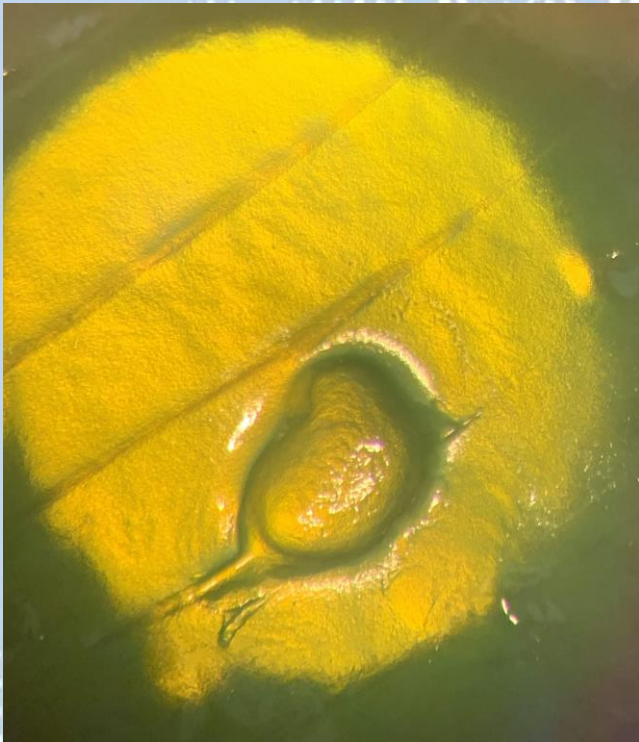
Oblique light: is it reflective?



Coaxial light: is it transparent?



# Retroillumination: is it transparent?



iPhone XS Max- operating microscope eye piece image



iPhone 7plus and 12x macro lens

# Patterns of oedema

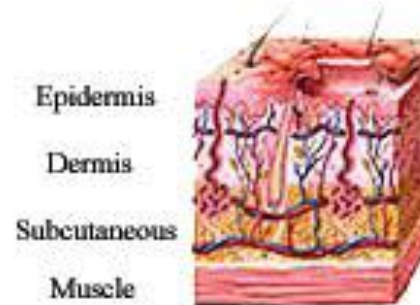
- Profound oedema  
think intraocular dz
  - Glaucoma
  - Uveitis
- Subtle focal oedema  
think corneal surface  
disease



# What are ulcers?

Loss of corneal tissue

- Superficial
- Deep
- Full thickness



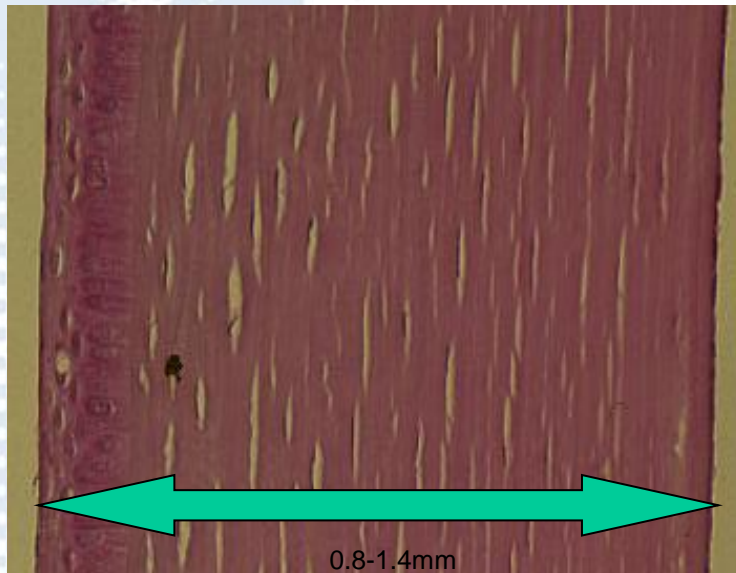
Superficial  
(first degree)  
burn



Partial thickness  
(second degree)  
burn



Full thickness  
(third degree)  
burn



# Classify ulcers:

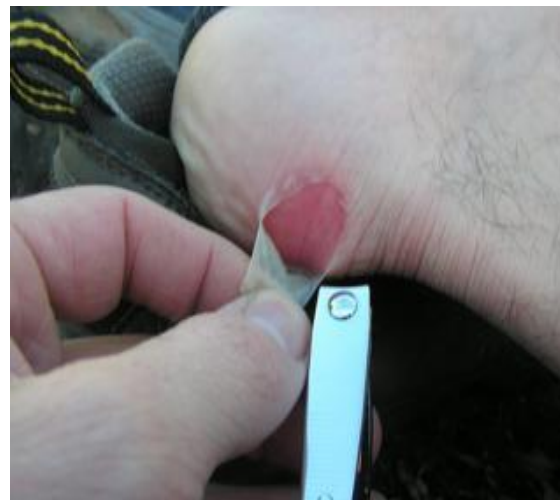
**1) Superficial uncomplicated corneal ulcer**

**2) Complicated corneal ulcer**



# Superficial uncomplicated corneal ulcer

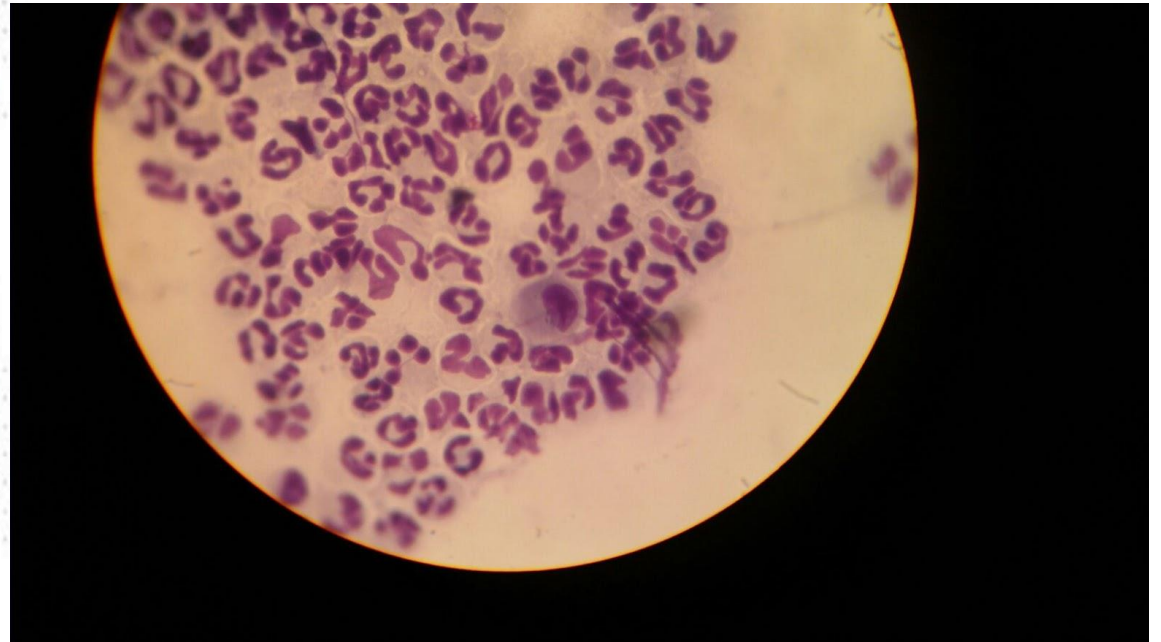
- Visual eyes, often **very** painful.
- No microorganisms (on culture or cytology)
- No cellular infiltrate
- No under-running of epithelial edges
- Epithelium well attached
- No foreign body
- No secondary uveitis
  - ddx reflex miosis
- Rapid healing (<7-10days)



# Corneal sampling techniques

---

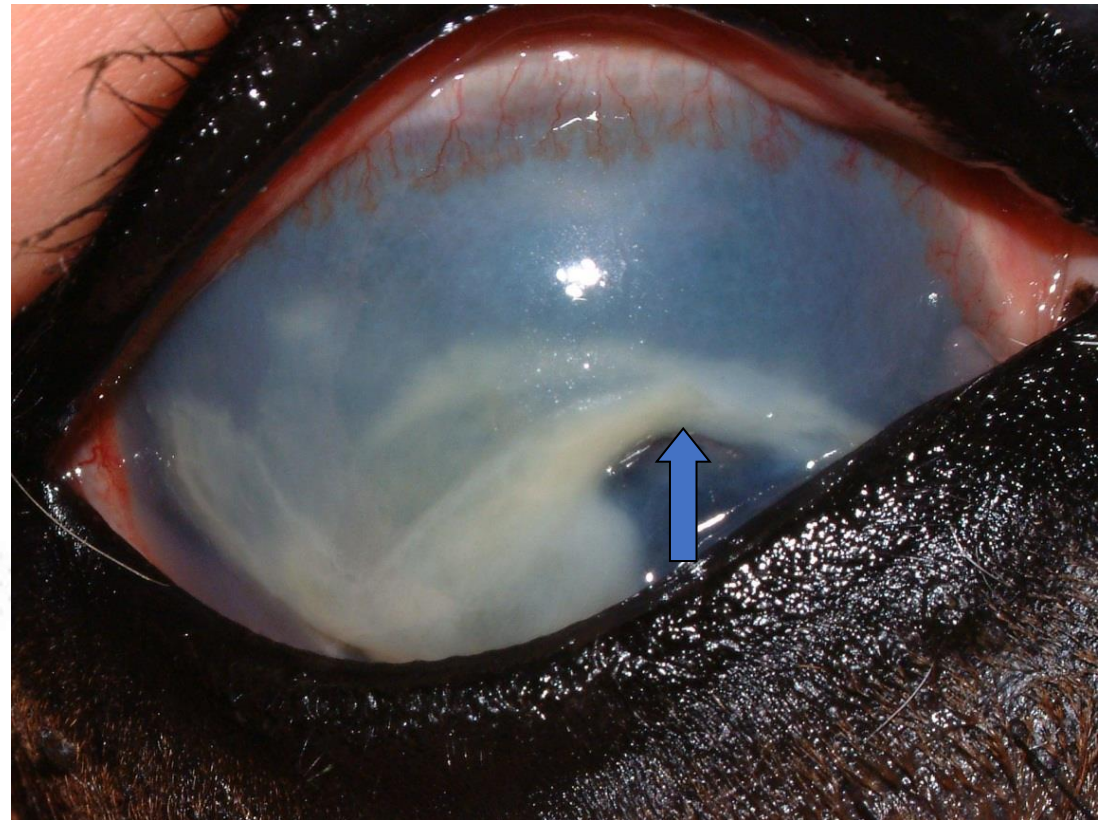
defining pathology

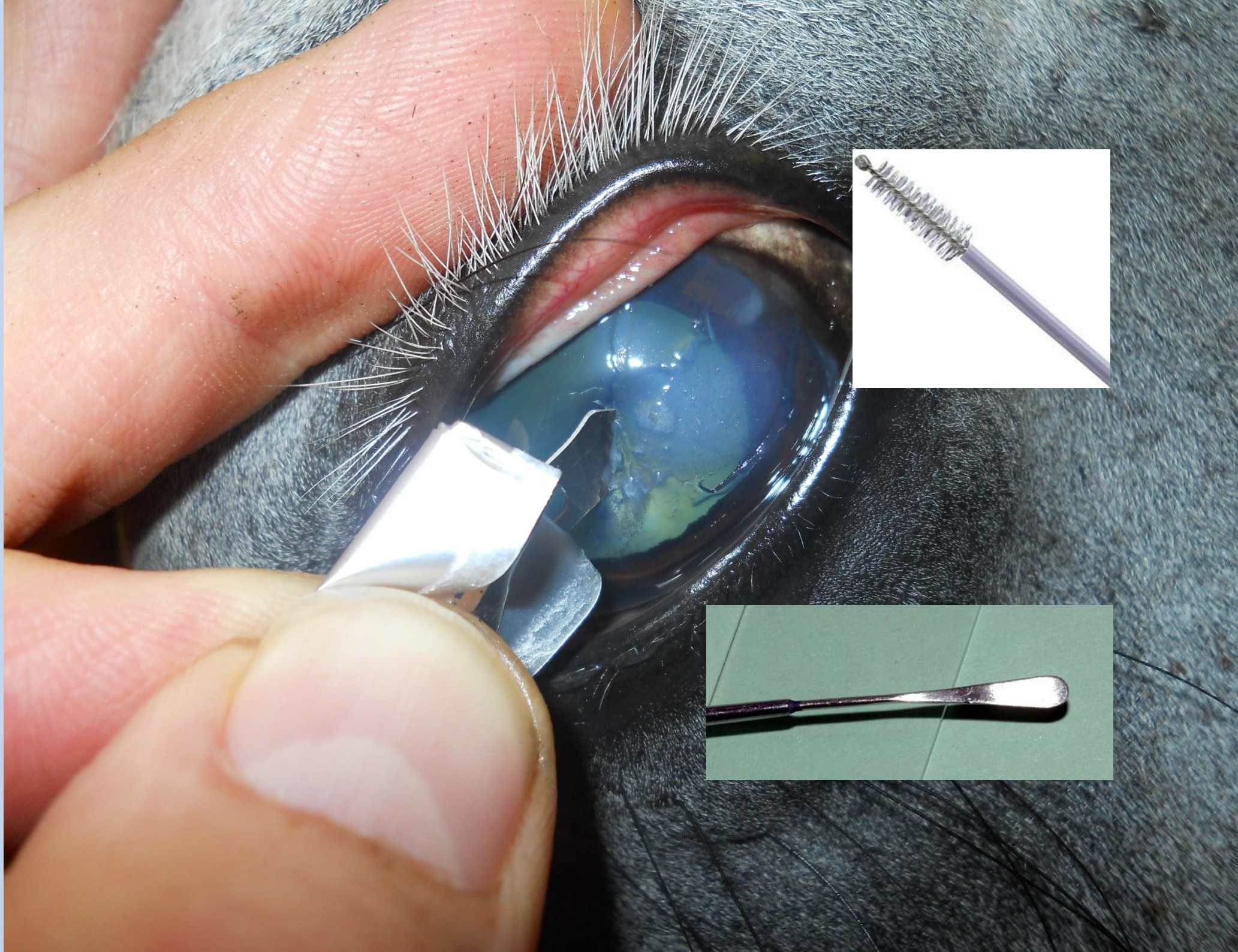


# Defining pathology: Bacteriology

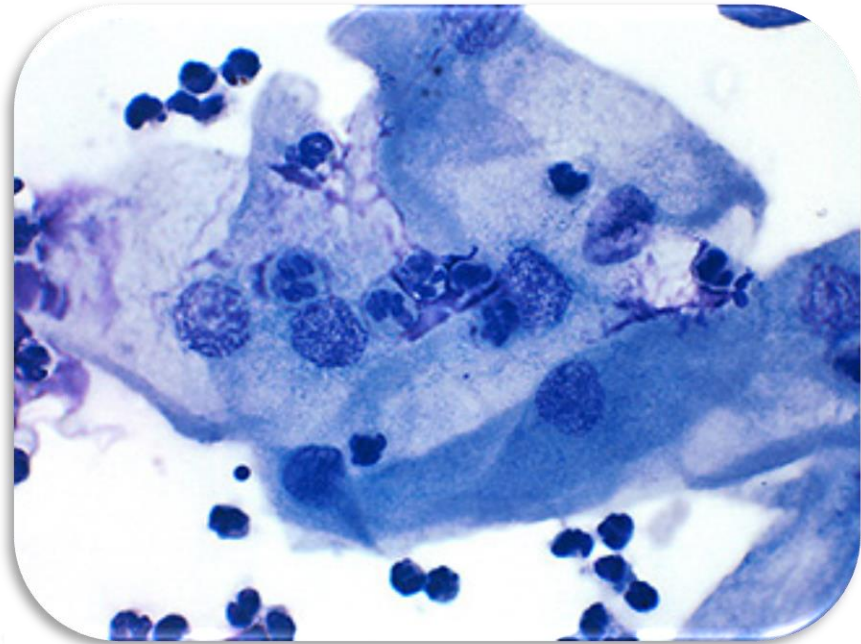
## • **Corneal culture**

- Use of topical anaesthetics improves sample
- Use a paediatric sized swab
- Sample from edge of ulcers
- Culture for bacteria and fungi
- And always do cytology too





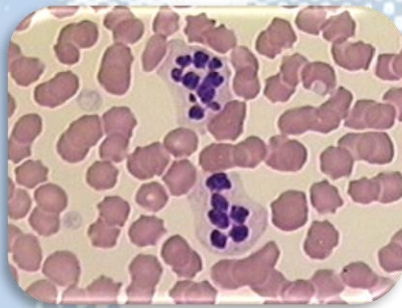
# Defining pathology: Corneal cytology



The presence of  
epithelial cells confirms  
a good scrape

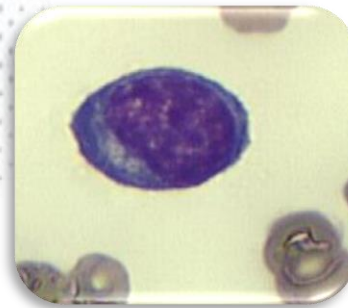
# Defining pathology: Corneal cytology

Neutrophil



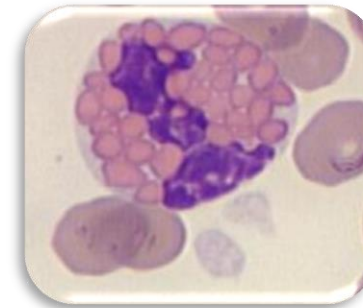
Bacterial and fungal  
infection

Lymphocytes  
Plasma cells



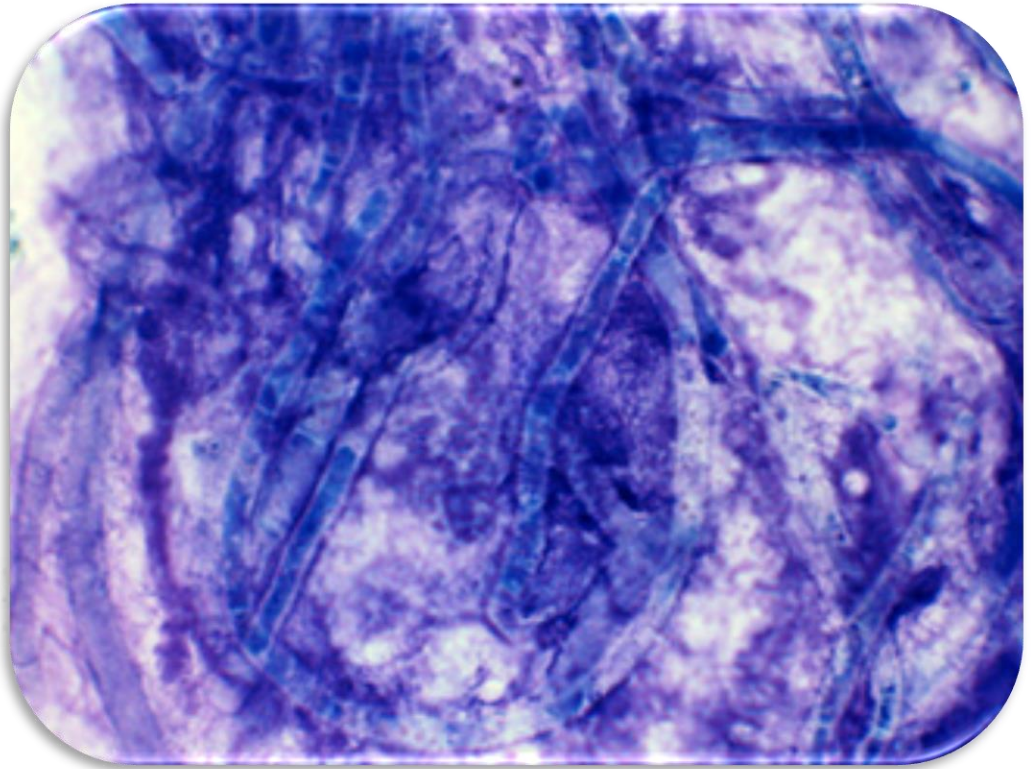
Immune-mediated / viral

Eosinophils



Immune-mediated or  
parasitic

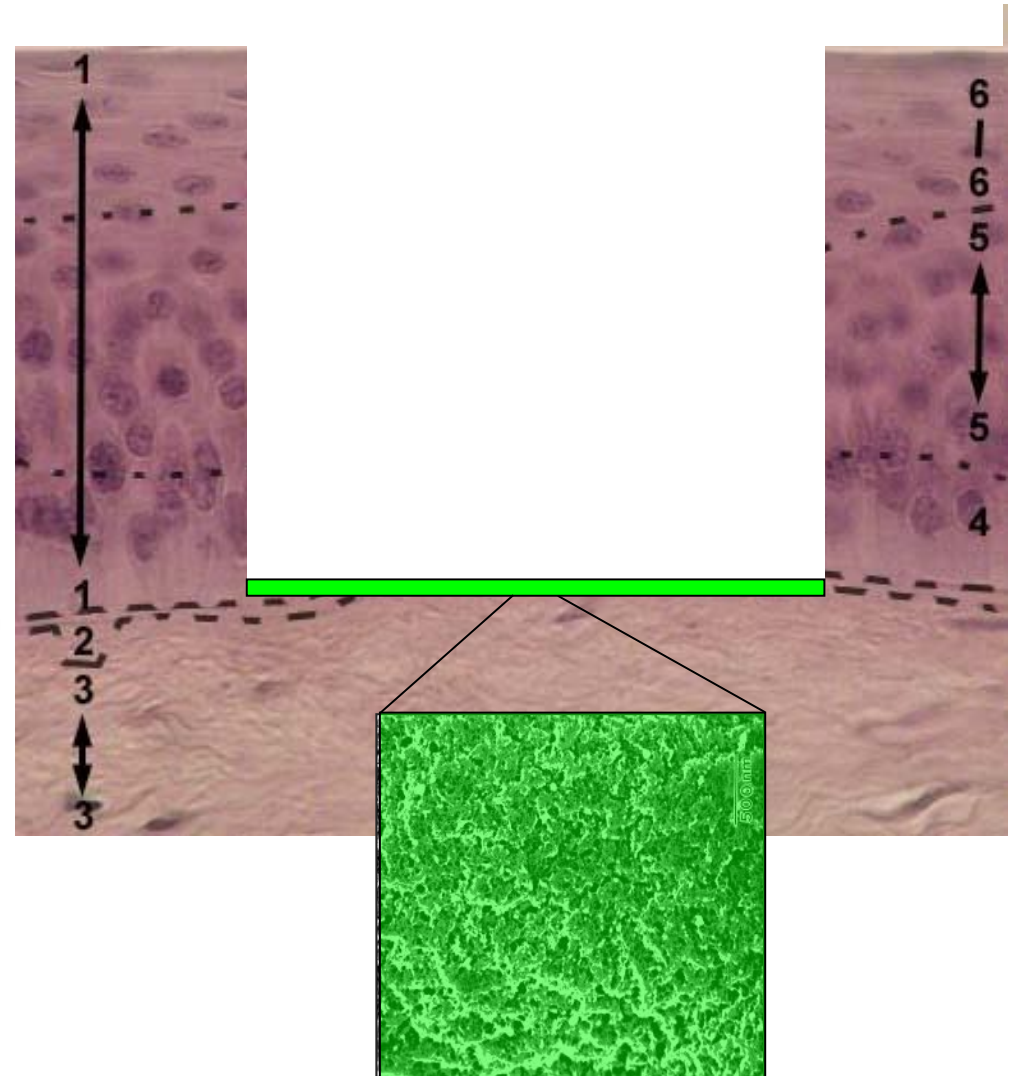
# Defining pathology: Corneal cytology



Fungal Hyphae

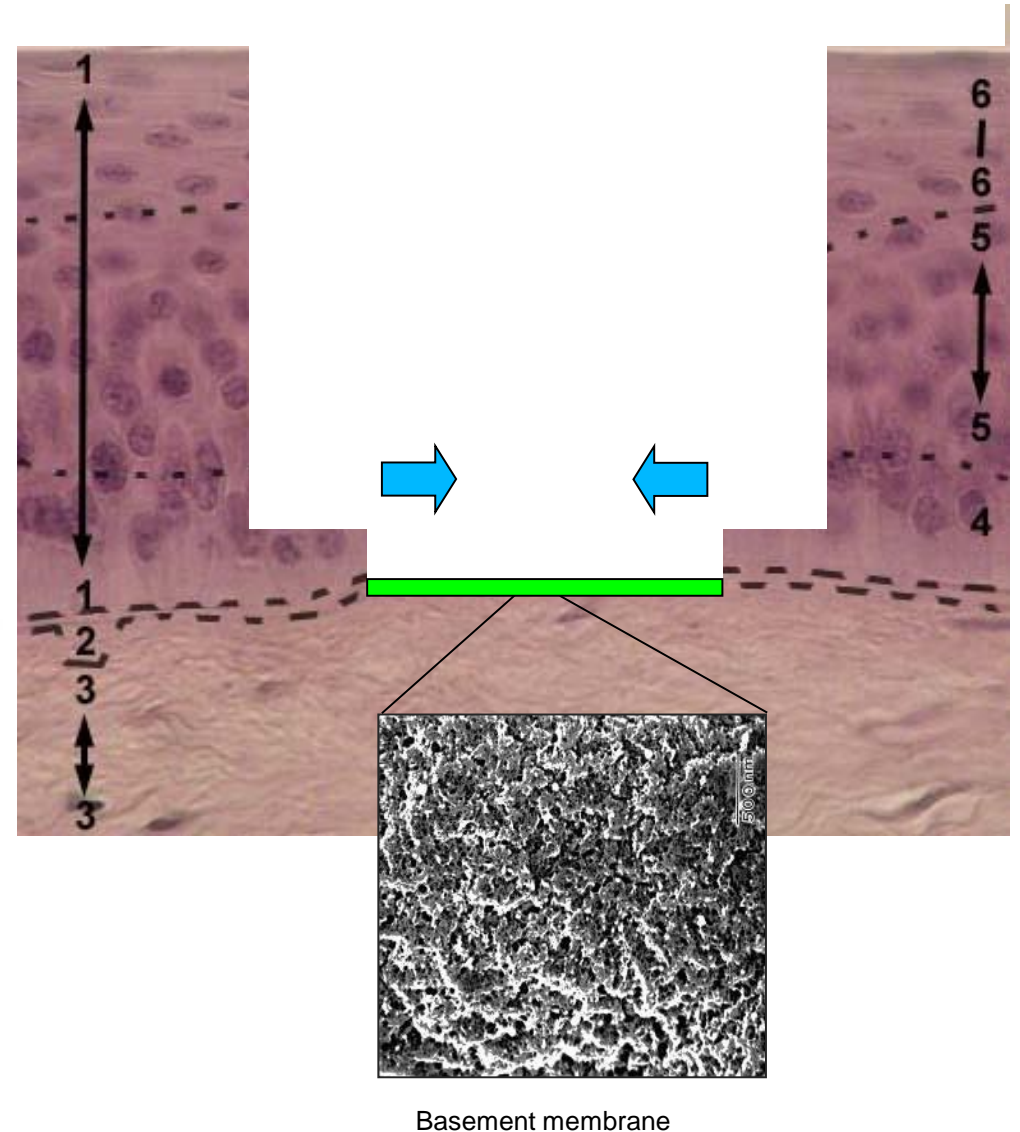
# Epithelial repair (superficial ulcers)

- 1) **Migration**– rapid (1 to 3 mm/day)
  - 2) **Attachment** – slow (days to weeks)
  - 3) **Division** – slow (30days)
- Fluorescein negative means intact epithelium but not normal epithelial thickness or attachment
  - Vascularisation has no effect on speed repair
  - Scarring not a feature of epithelial wounds
  - Remove cause then rapid healing the norm
  - Environment key
    - Nutrition
    - Oxygen
  - Lubricate for 30days post fluorescein negative



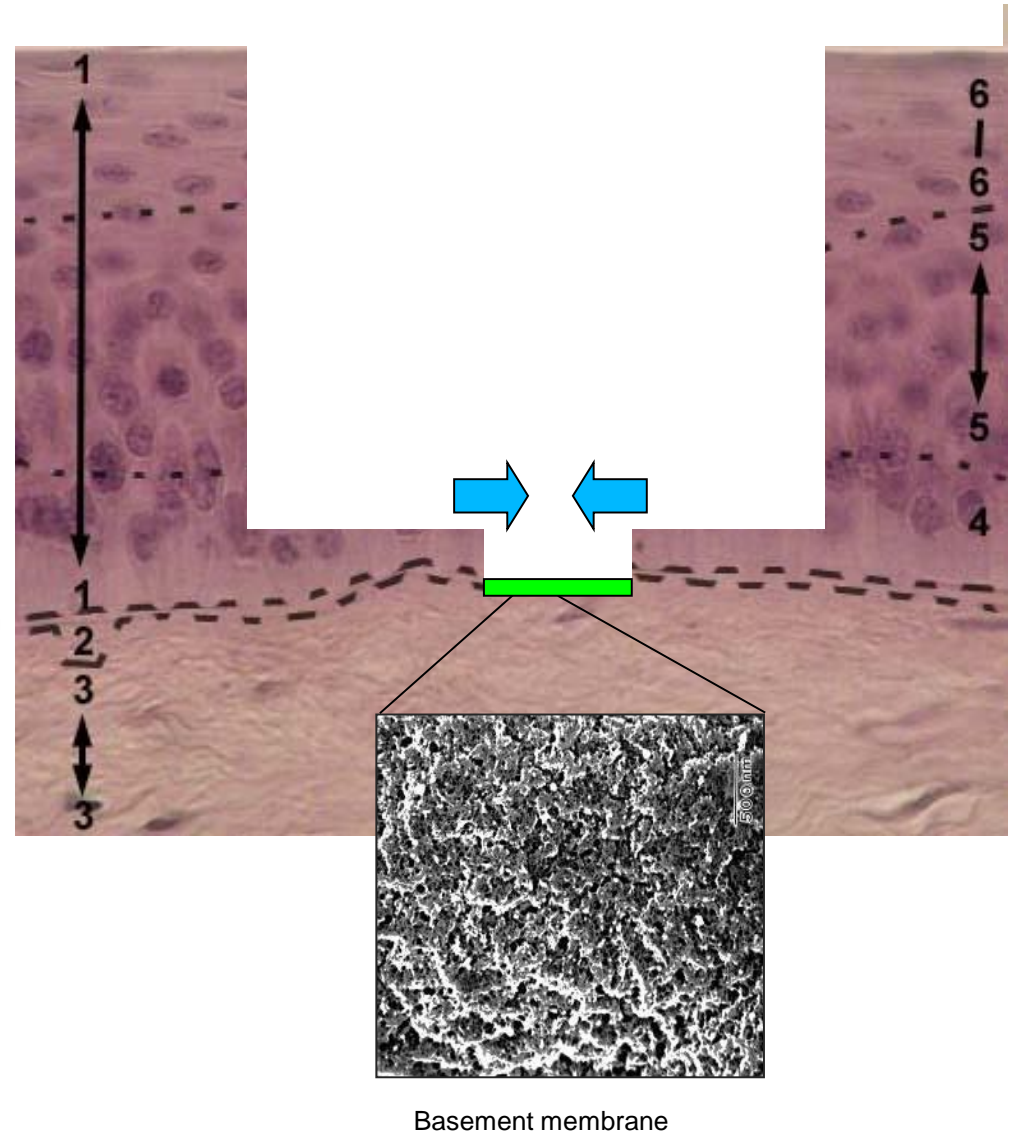
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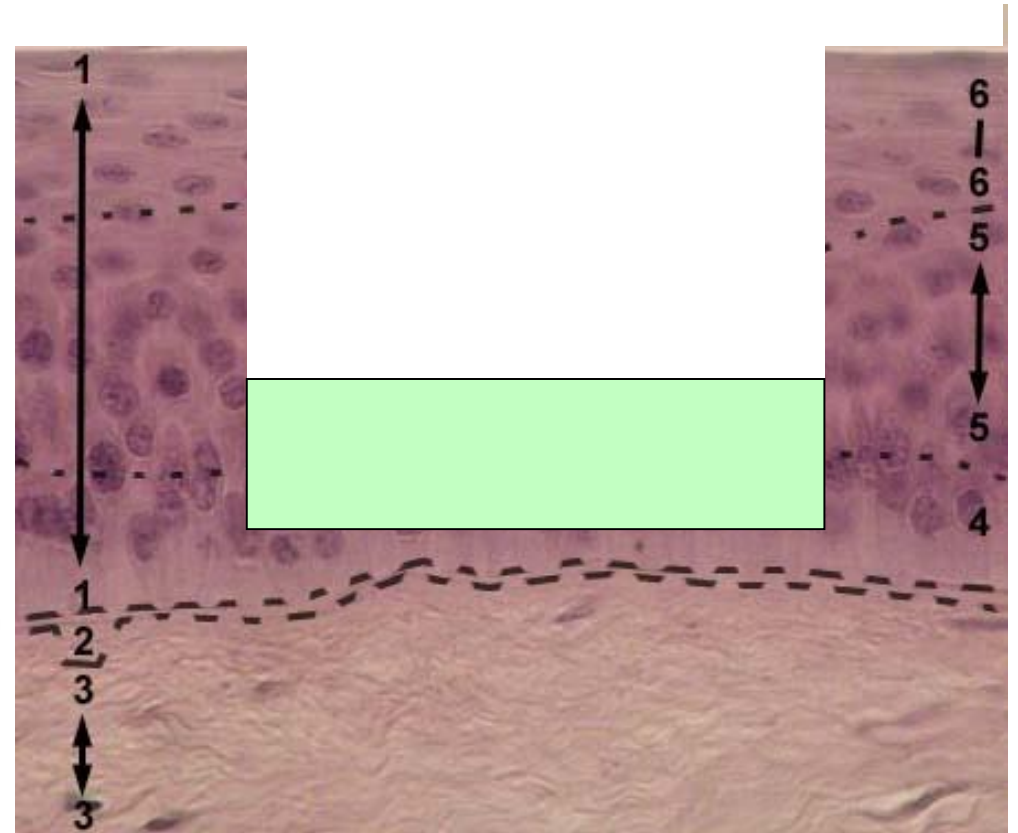
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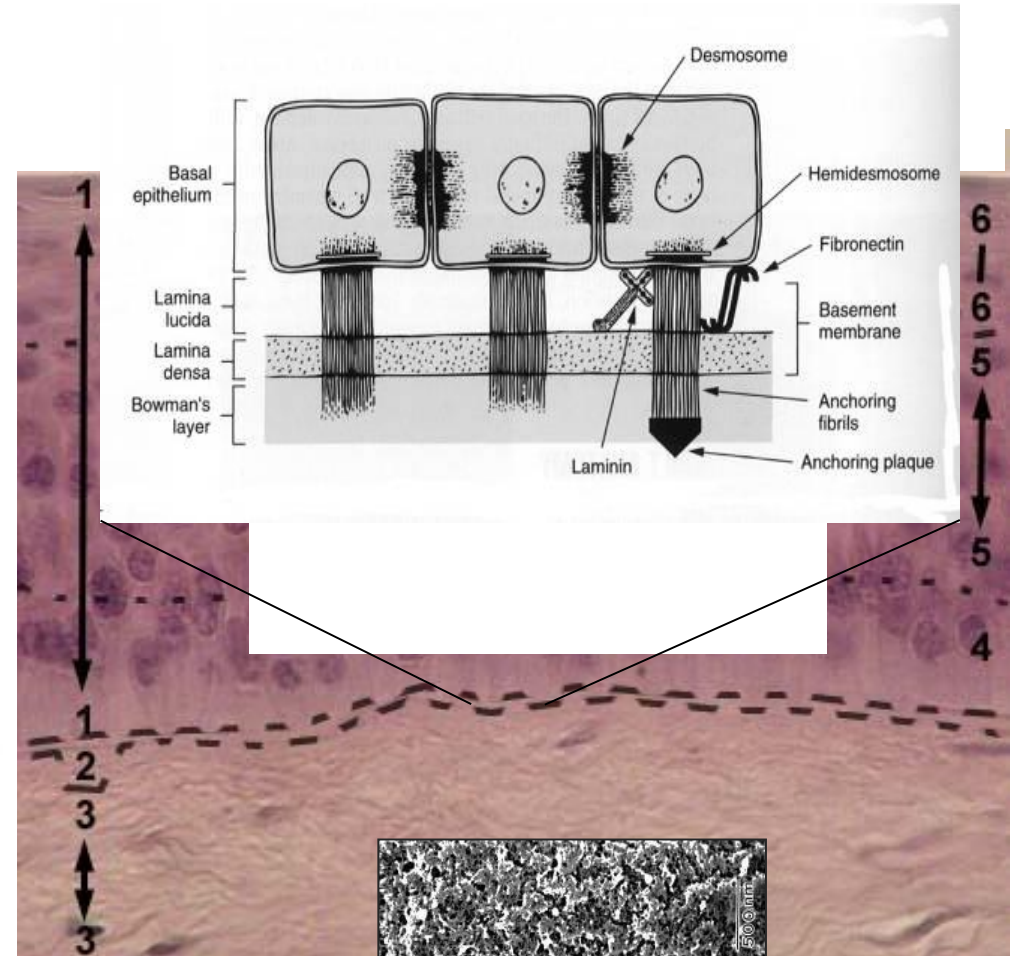
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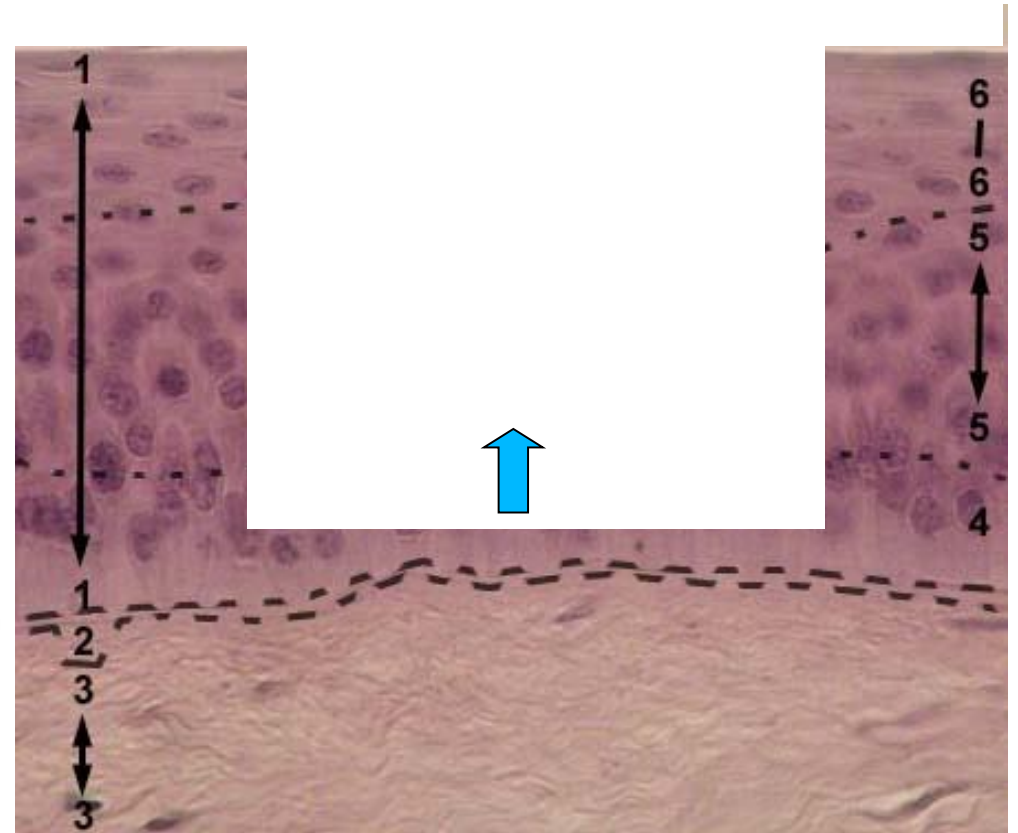
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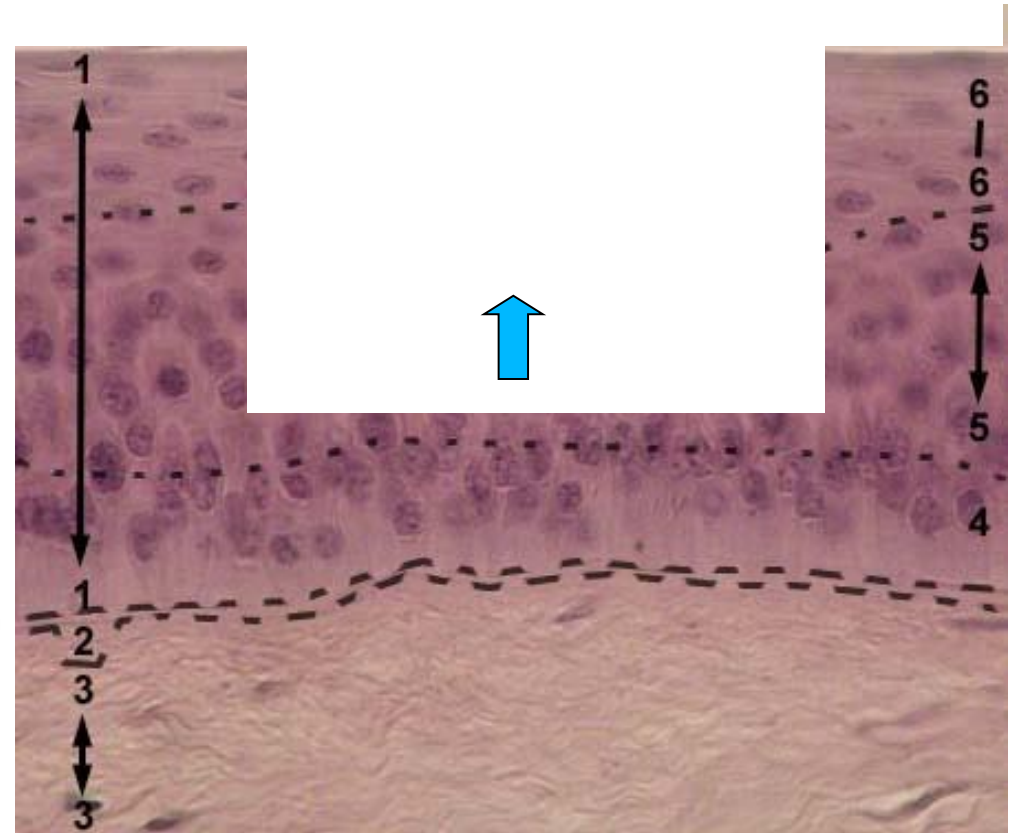
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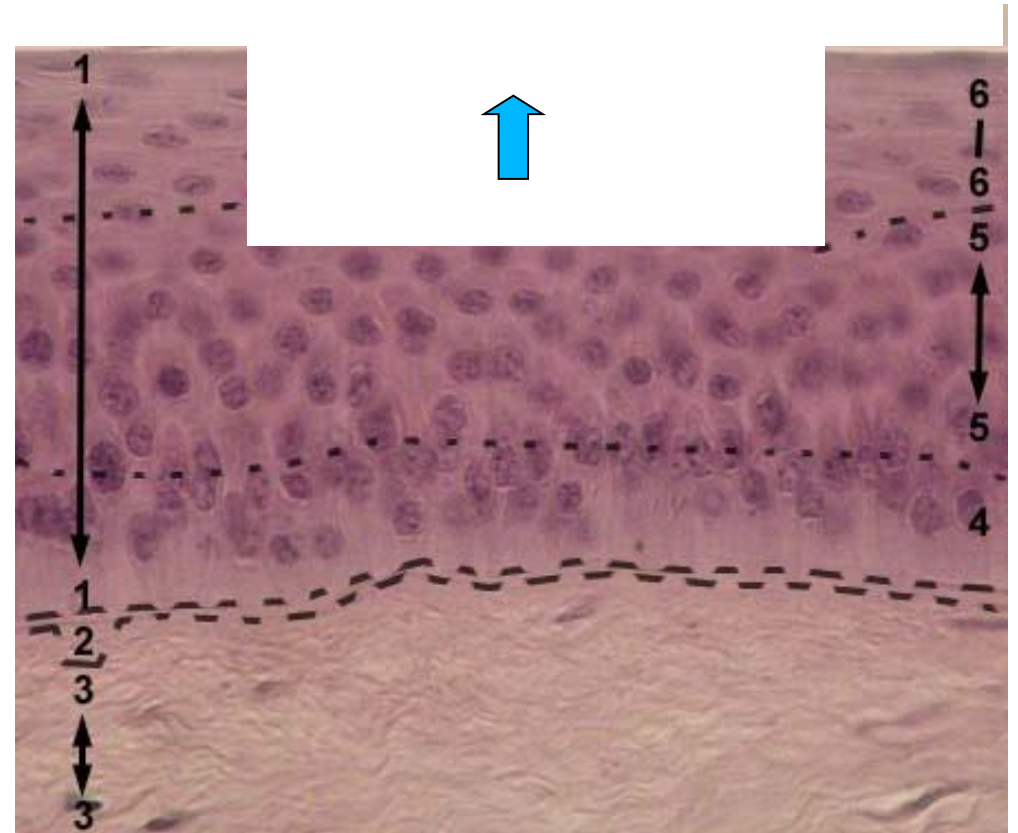
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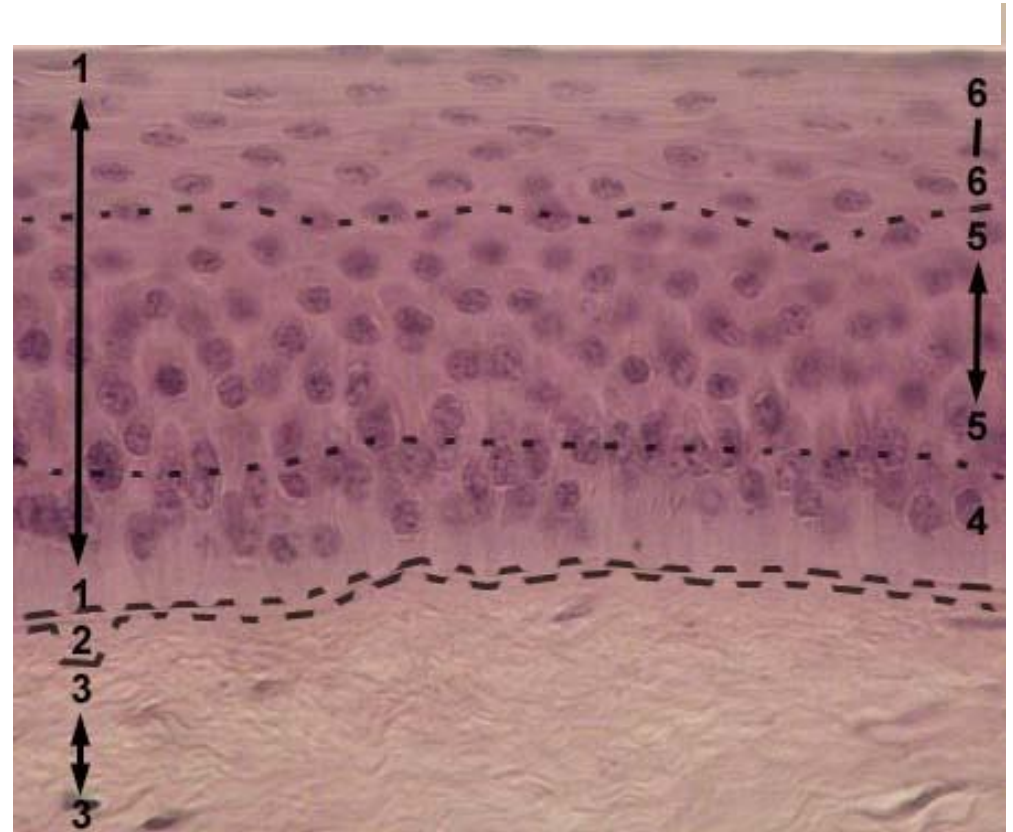
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# Treatment of uncomplicated ulceration.

Identification of cause main aim.  
*Ulcers heal un-aided once cause removed.*

Prevention of secondary infection and progression to melting or stromal infection with broad spectrum antibacterials advised.

Chloramphenicol good choice.

Atropine to relieve painful miosis often associated with corneal lesions.

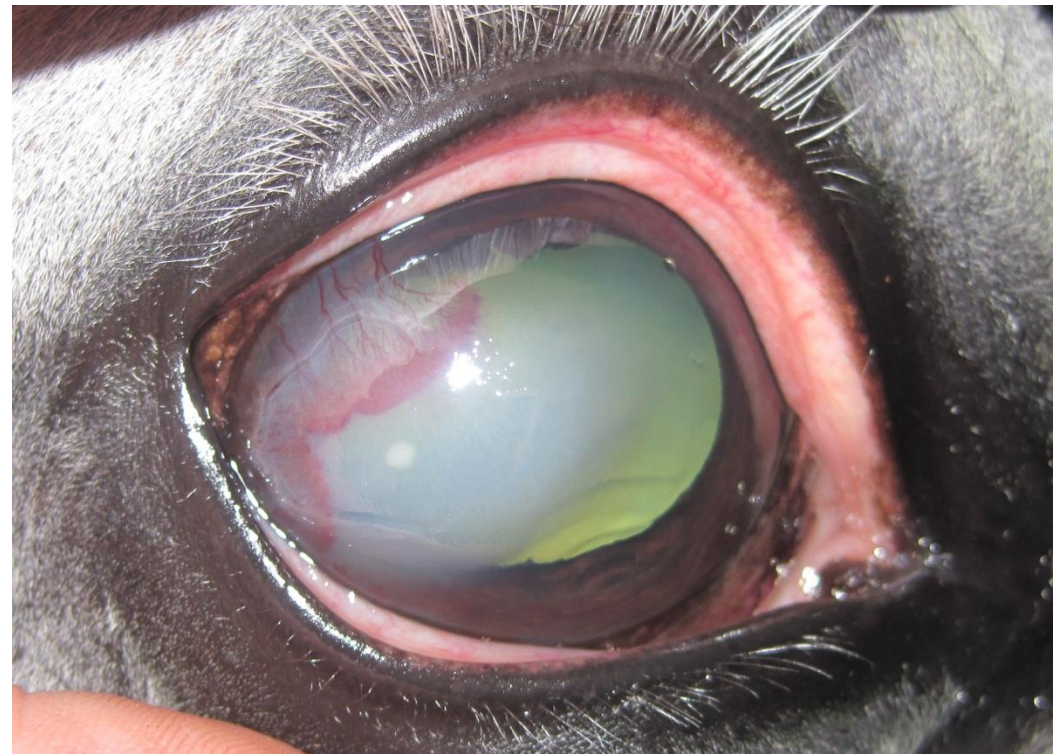
Lubrication – viscotears, hyaluronate.

Prevention self trauma – fly masks, systemic analgesia, simplify environment – hay net on floor etc.

Consider use of bandage contact lens for pain control in large lesions.

NEVER USE STEROIDS (and care with topical NSAID's).

Vascularisation is not a sign of healing in superficial ulceration





# Complicated Corneal Ulcers

Poor epithelial attachment?

(multiple ulcers)

Corneal defect?

Corneal infiltration?

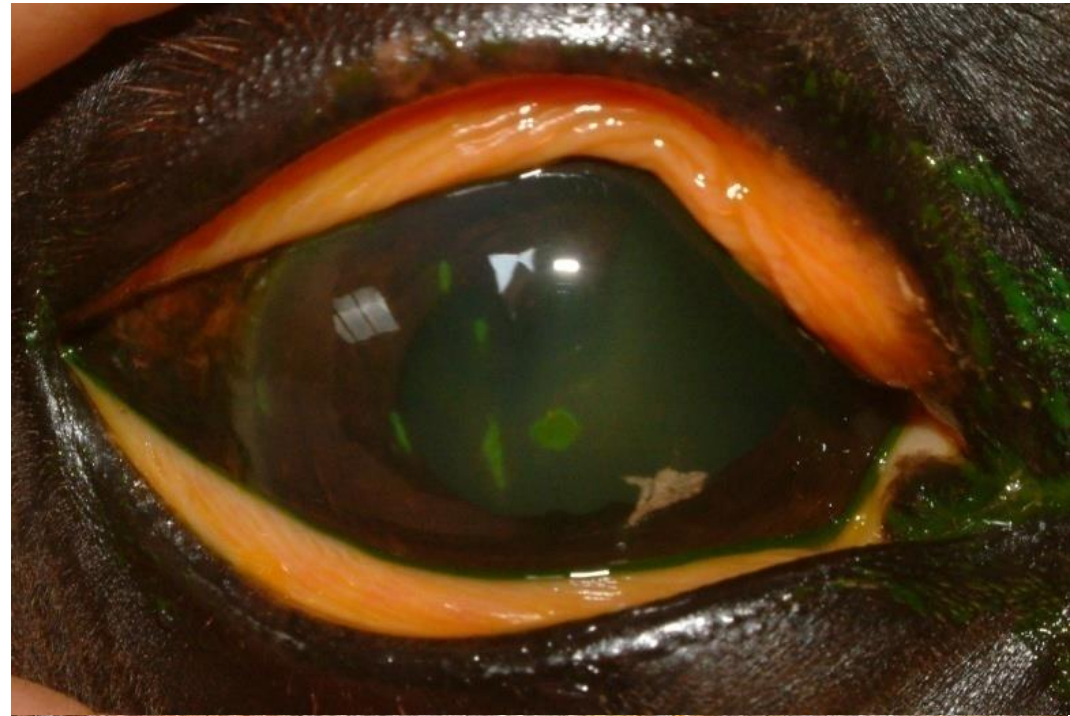
Corneal vascularisation?

Significant corneal  
oedema?

Chronic or recurrent?

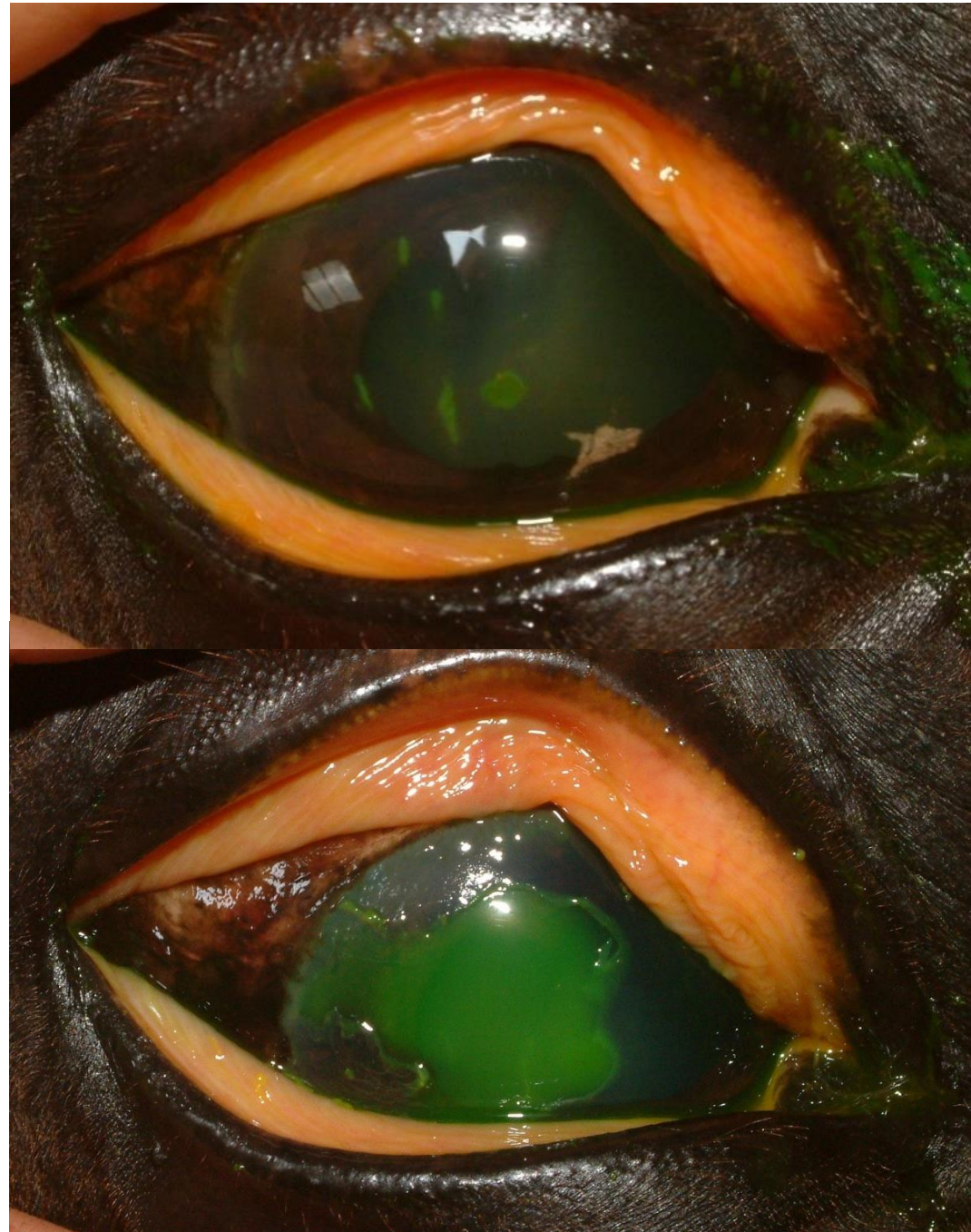
Uveitis?

Visual changes?



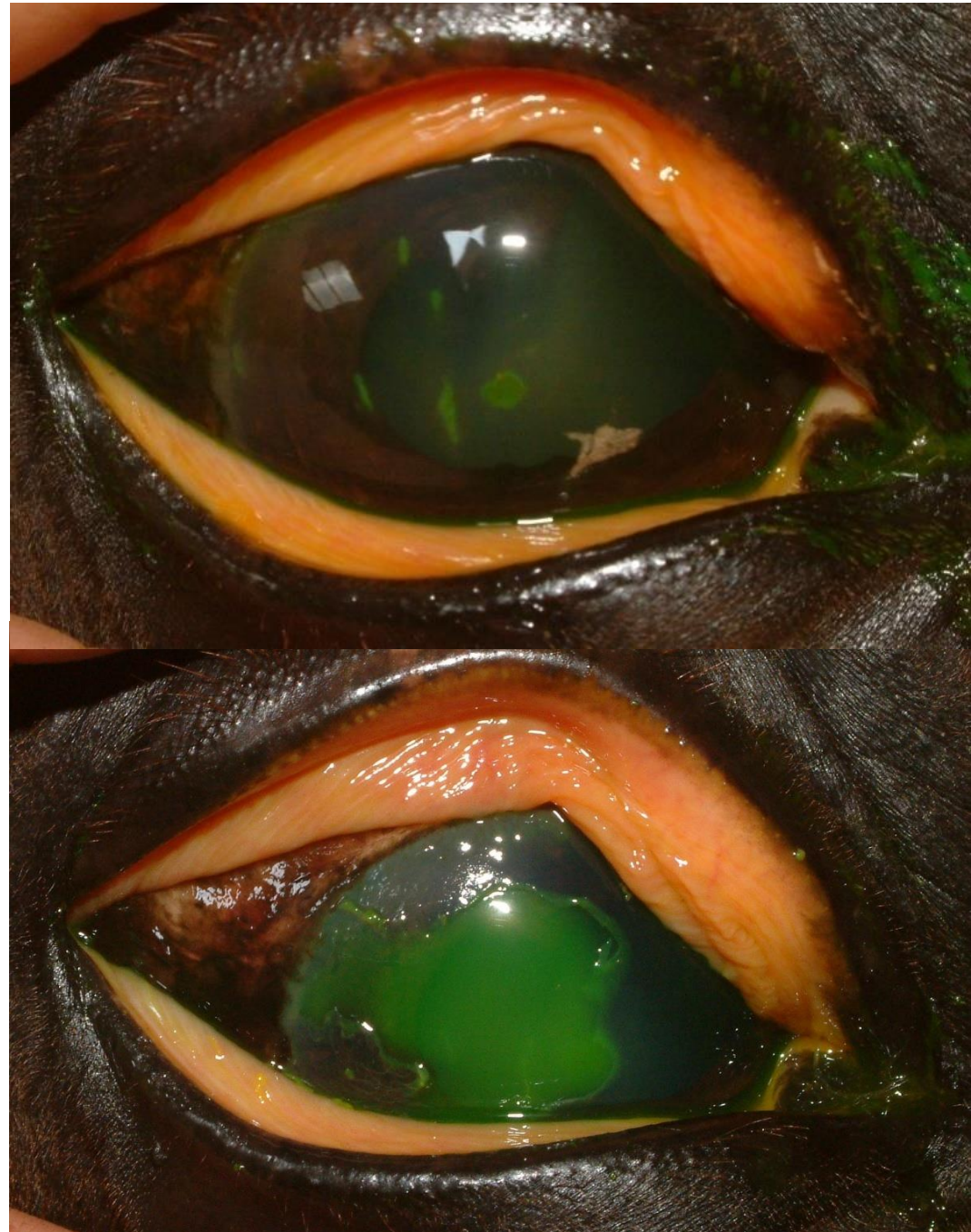
# Complicated Corneal Ulcers

1. **Indolent ulcers**
2. Deep ulcers
3. Descemetocoeles
4. Perforations
5. **melting corneal ulcers**
6. Mycotic / fungal infections
7. *Non ulcerative keratopathies*



# Complicated Corneal Ulcers

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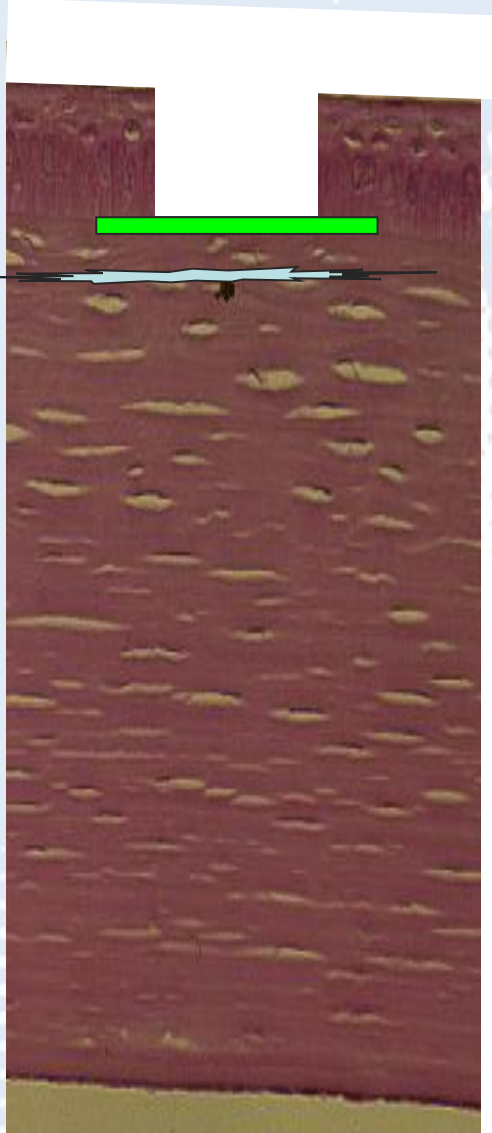




When **superficial** healing fails

# **INDOLENT CORNEAL ULCERS**

# Indolent ulcers



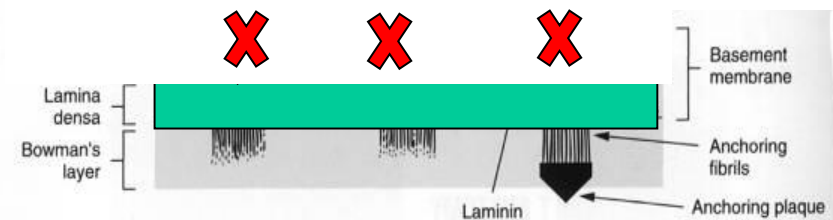
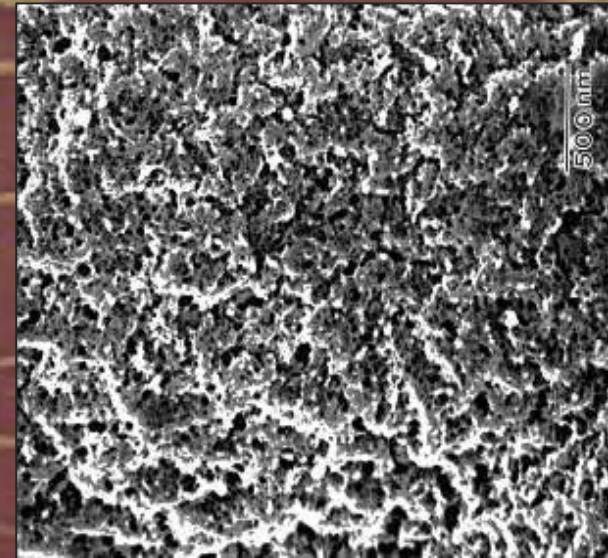
# Indolent ulcer formation

Recurrent or ongoing corneal trauma

Exposure

Foreign body

Steroids



# Indolent ulcer formation

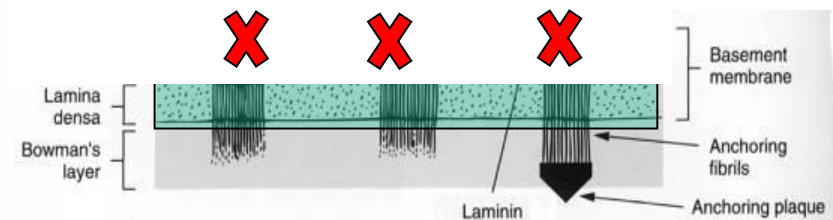
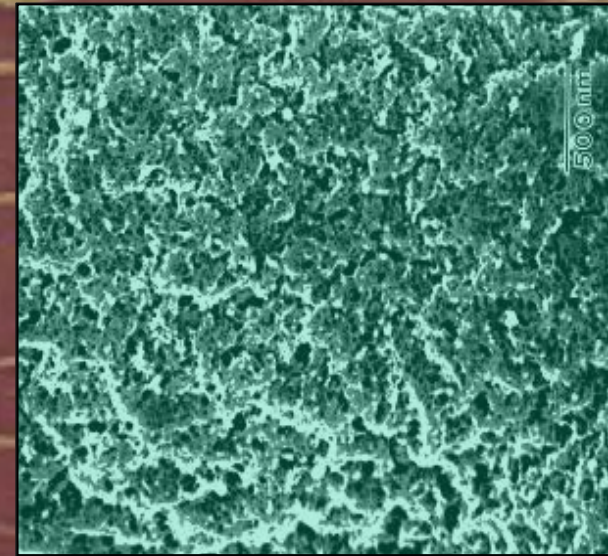
Recurrent or ongoing corneal trauma

Exposure

Foreign body

Steroids

x1



# Indolent ulcer formation

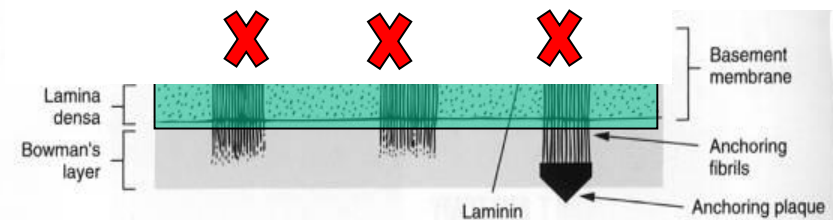
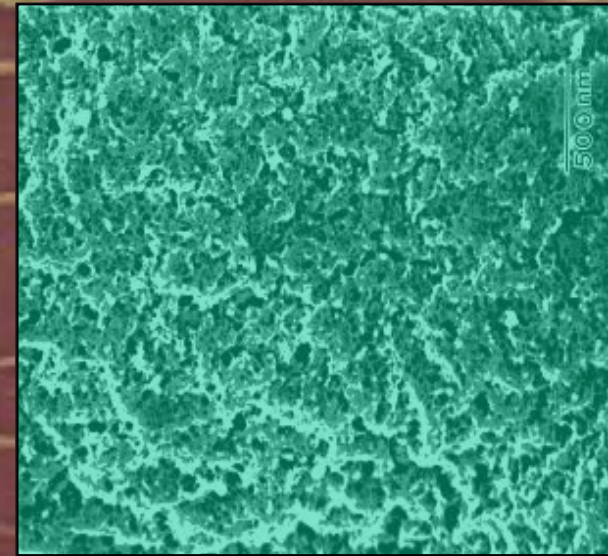
Recurrent or ongoing corneal trauma

Exposure

Foreign body

Steroids

x2



# Indolent ulcer formation

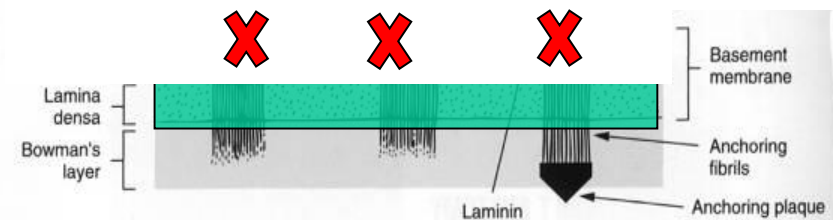
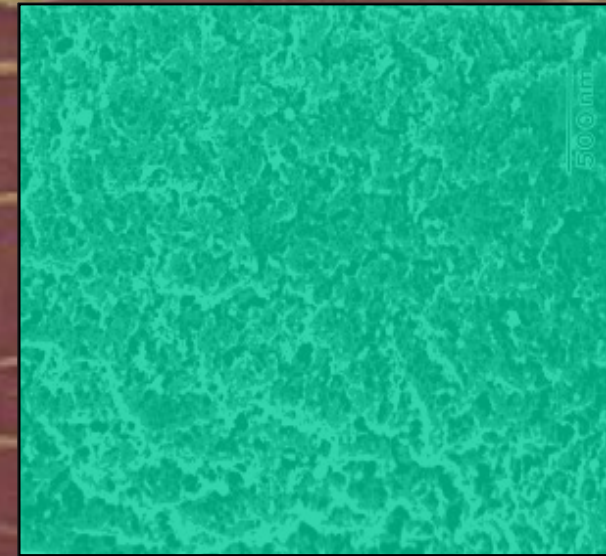
Recurrent or ongoing corneal trauma

Exposure

Foreign body

Steroids

x3



# Indolent ulcer formation

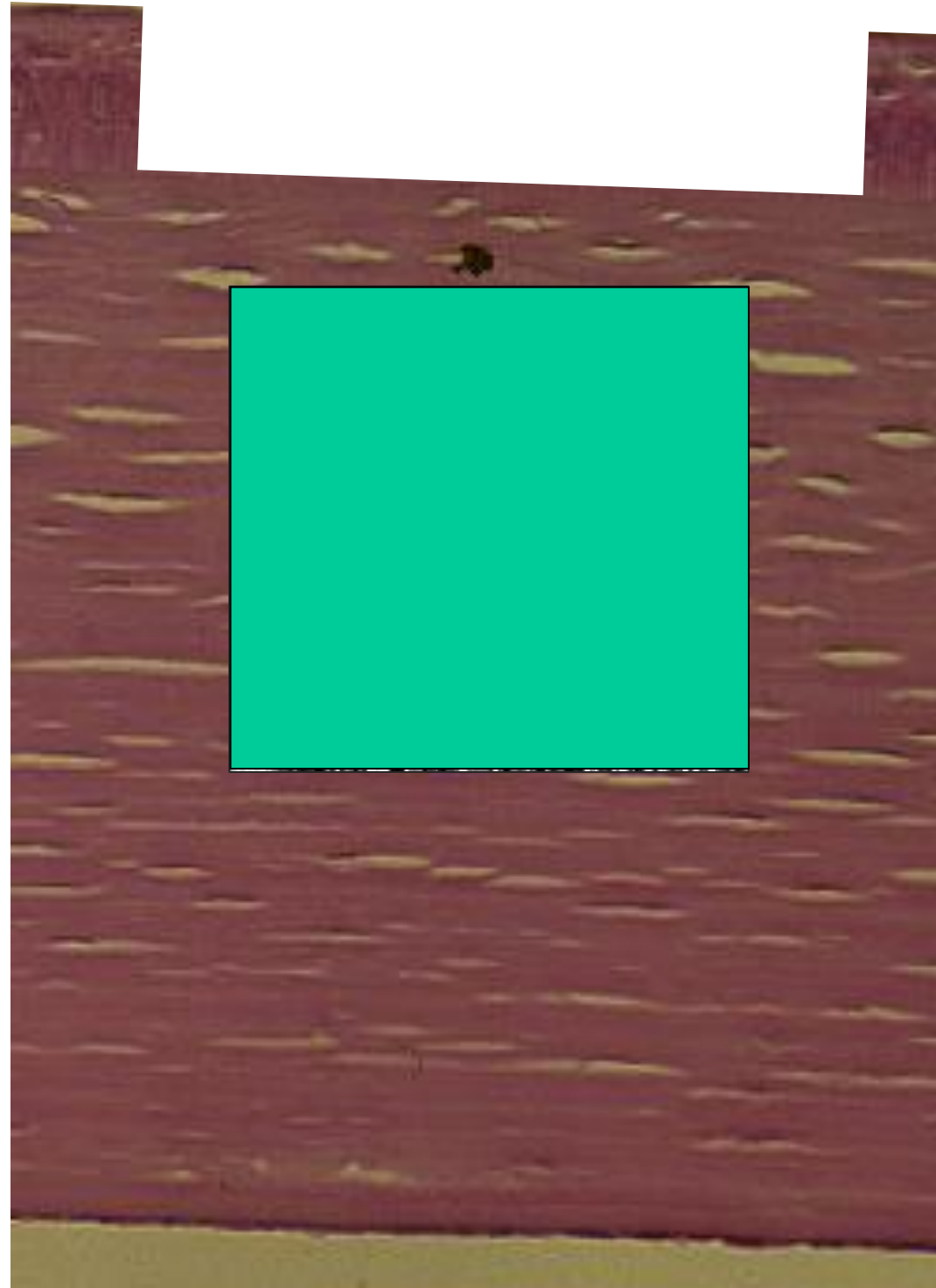
**Recurrent or ongoing corneal trauma**

Exposure

Foreign body

Steroids

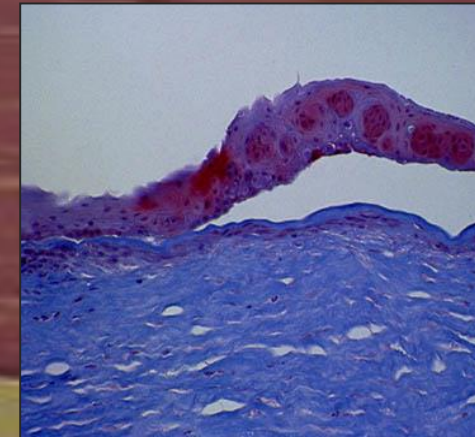
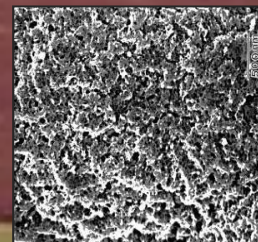
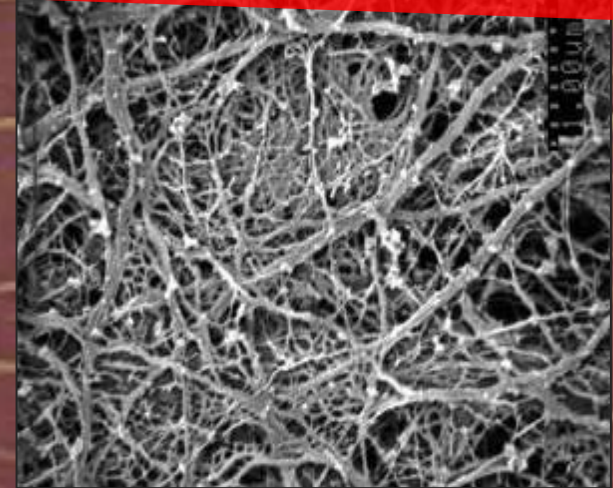
x4



# Indolent ulcer formation

Recurrent or ongoing corneal trauma

1. Loss basement membrane
2. Anterior stromal cell death
3. Anterior hyalinised membrane formation?  
(or sequestrum )
4. Neovascularisation & redundant epithelial border



# Treatment of the indolent ulcer.

## Aims

- Identification of cause
- Remove non-adherent epithelium
- Improve epithelial environment
- Reduce friction
- Encourage epithelial attachment
- Consider surgical methods to breach anterior stromal membrane if medical treatment fails

## Tools

- Client education
- Sterile cotton buds
- Contact lens
- Serum
- Tetracyclines?
- Surgery

# Indolent ulcer medical treatment

## Tetracyclines

Decrease MMP

Promote epithelialization

Systemic (doxycycline)  
& topical



## Topical serum

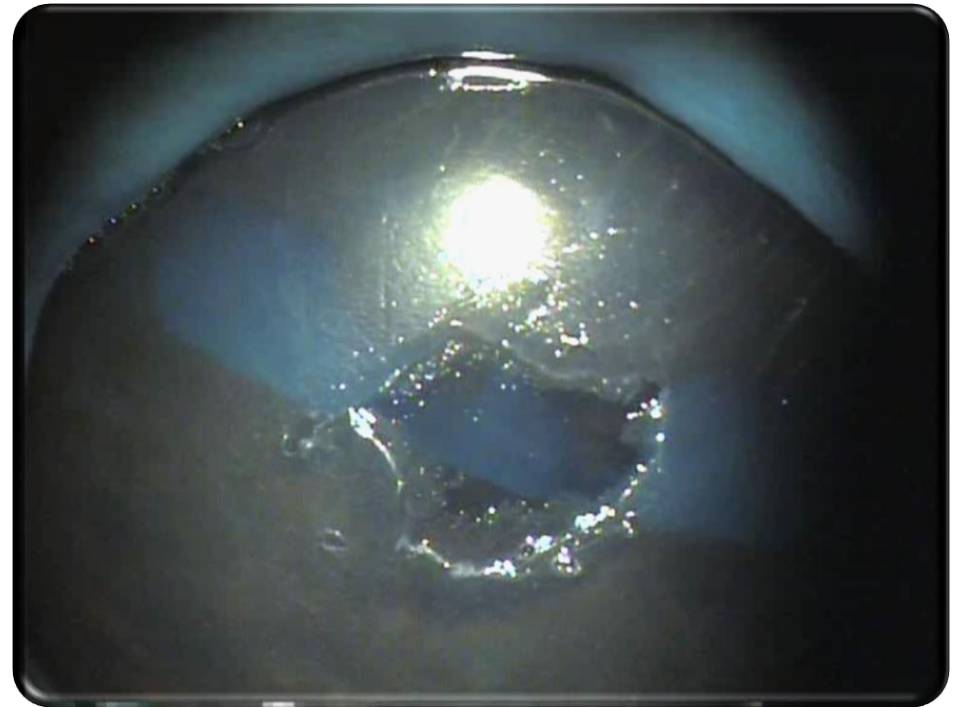
Growth factors

Decrease MMP

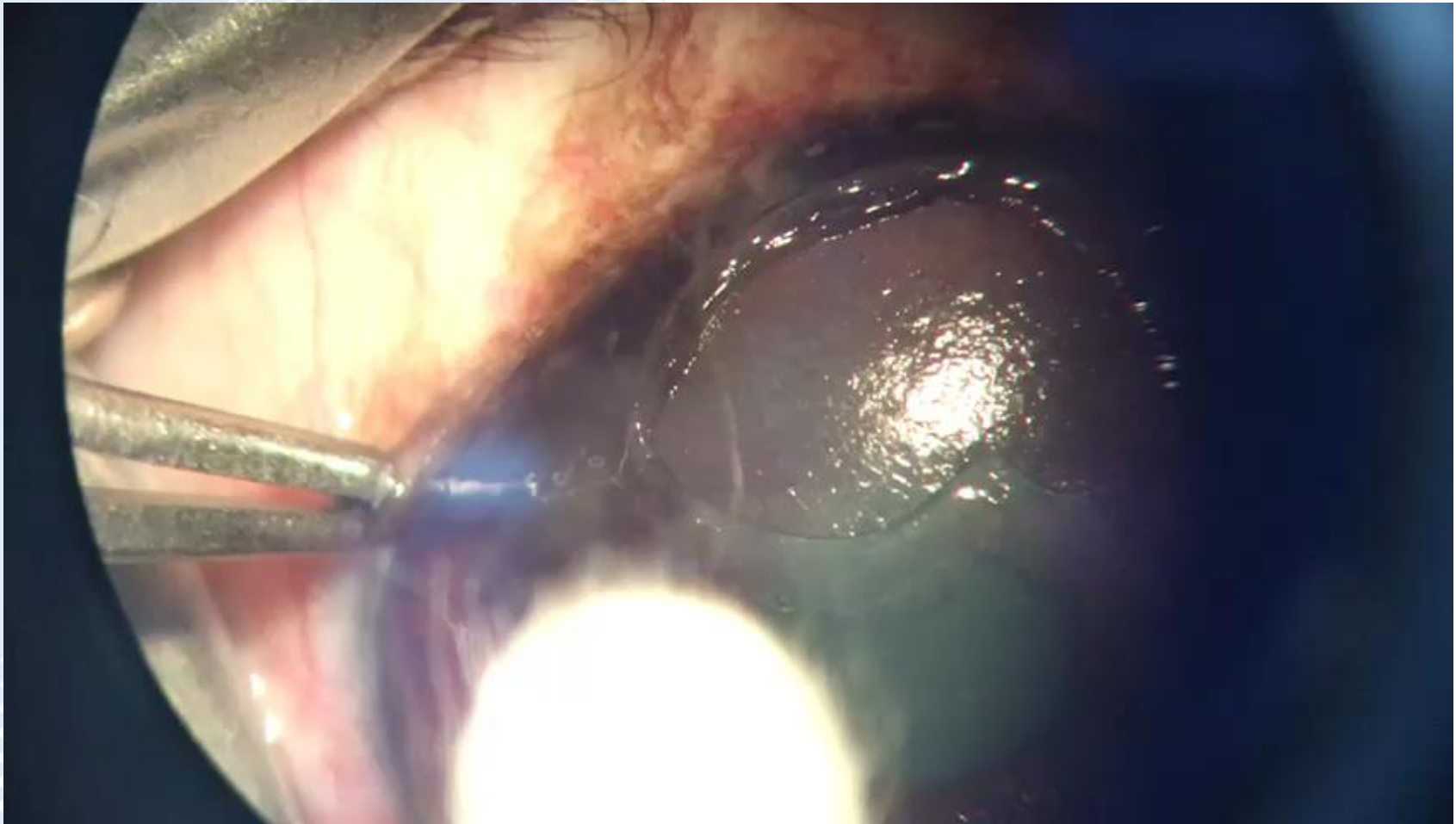
## Hyaluronate



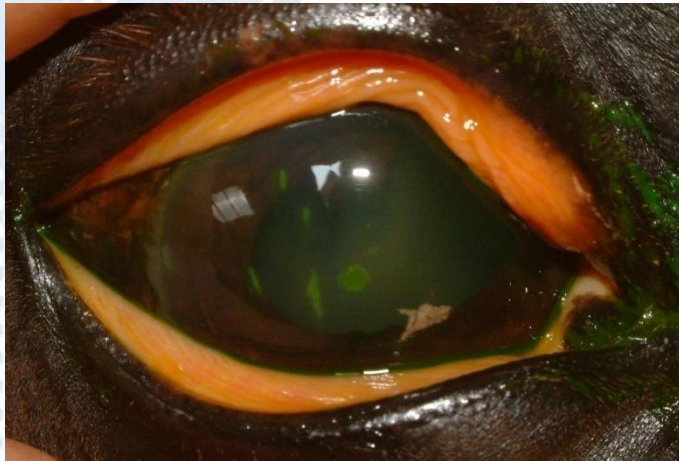
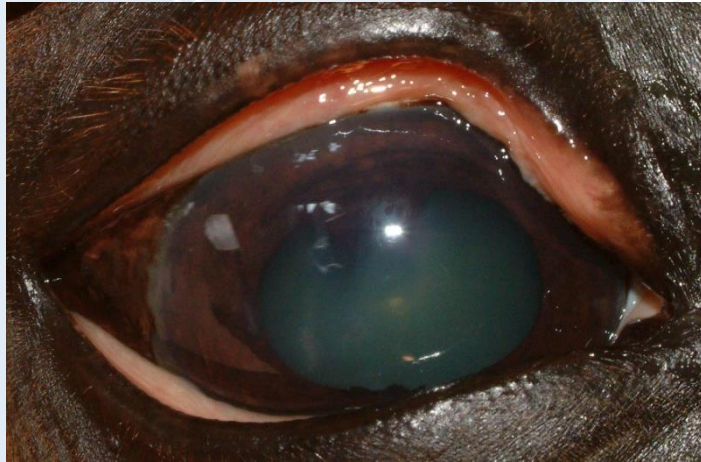
# Debridement



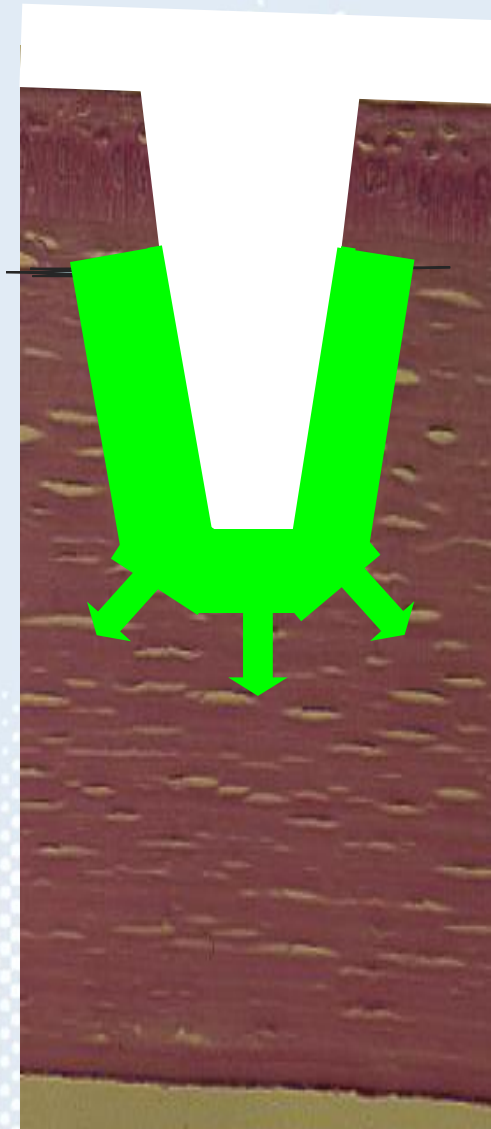
# Debridement



# Debridement and lens



# Stromal ulcers



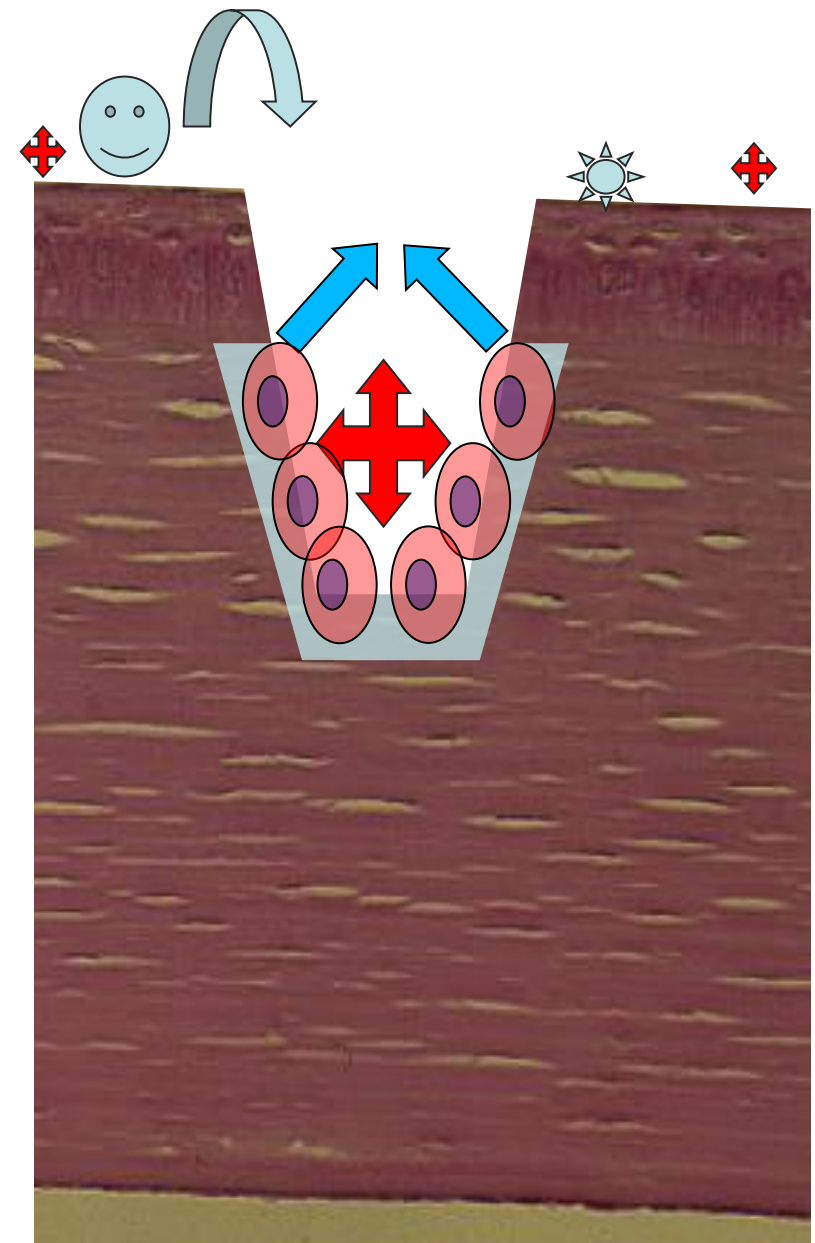
# Stromal repair (deep ulcers)

- 4 stages
  - **Cell death** ! A depressing start.. Immediate
    - ✦ Neutrophils recruited from tear film
    - ✦ MMPs – friend or foe
    - ✦ Stimulate healing
    - ✦ Recruit neutrophils from tear film
  - **Proliferation and migration**.. 5-7days
  - **Transformation** .. 30days
  - **Remodelling and scar formation**.. 12months
- Speed increases with vascularisation as does scarring



# Stromal repair

- 4 stages
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Lacrimal gland



PMN



Cytokines



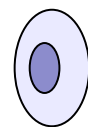
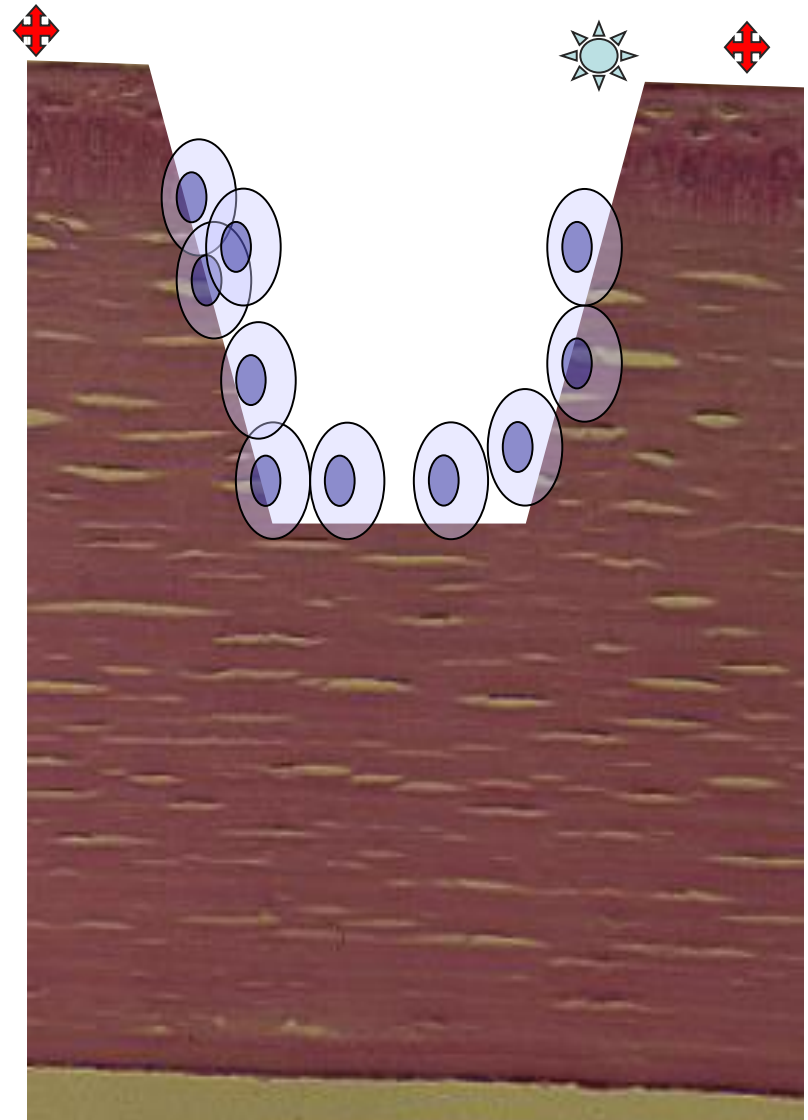
MMP's



Bacteria

# Stromal repair

- 4 stages
  - **Cell death** ! A depressing start.. Immediate
    - ✦ Neutrophils recruited from tear film
    - ✦ MMPs – friend or foe
    - ✦ Stimulate healing
    - ✦ Recruit neutrophils from tear film
  - **Proliferation and migration**.. 5-7days
  - **Transformation** .. 30days
  - **Remodelling and scar formation**.. 12months
- Speed increases with vascularisation as does scarring



Stromal cc



Cytokines



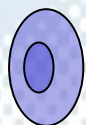
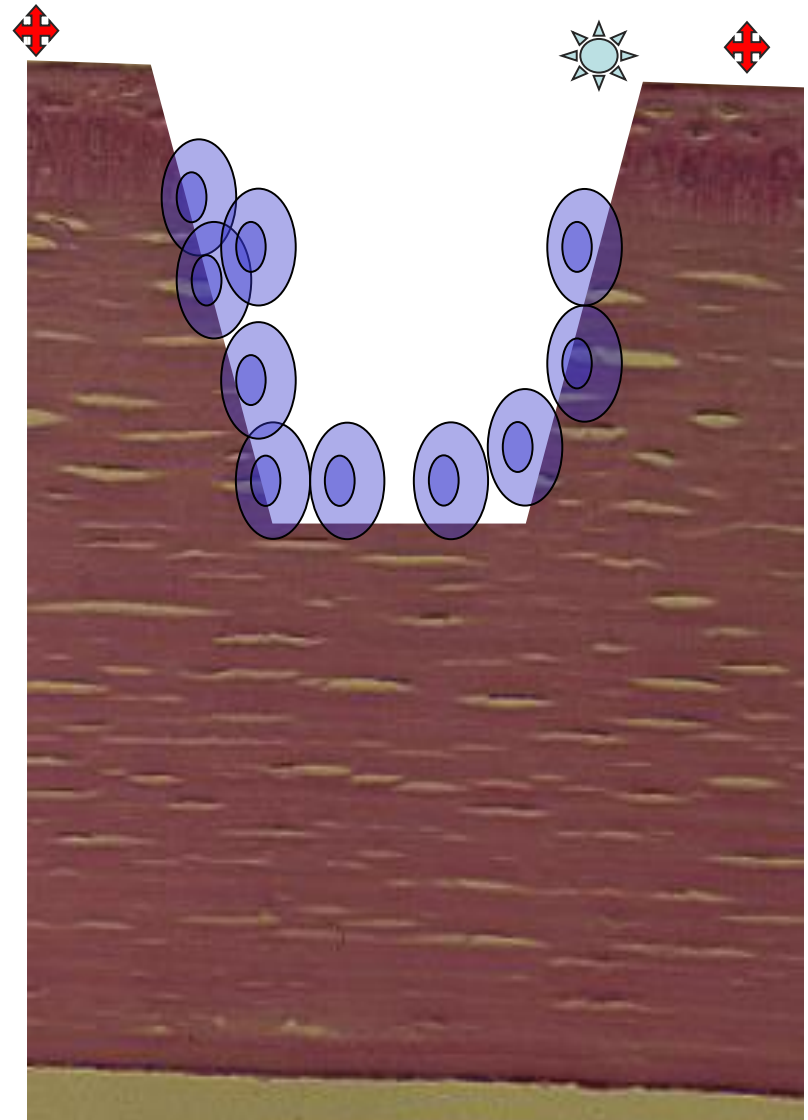
MMP's



Bacteria

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Transformed stromal cc (fibroblast)



Cytokines



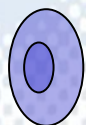
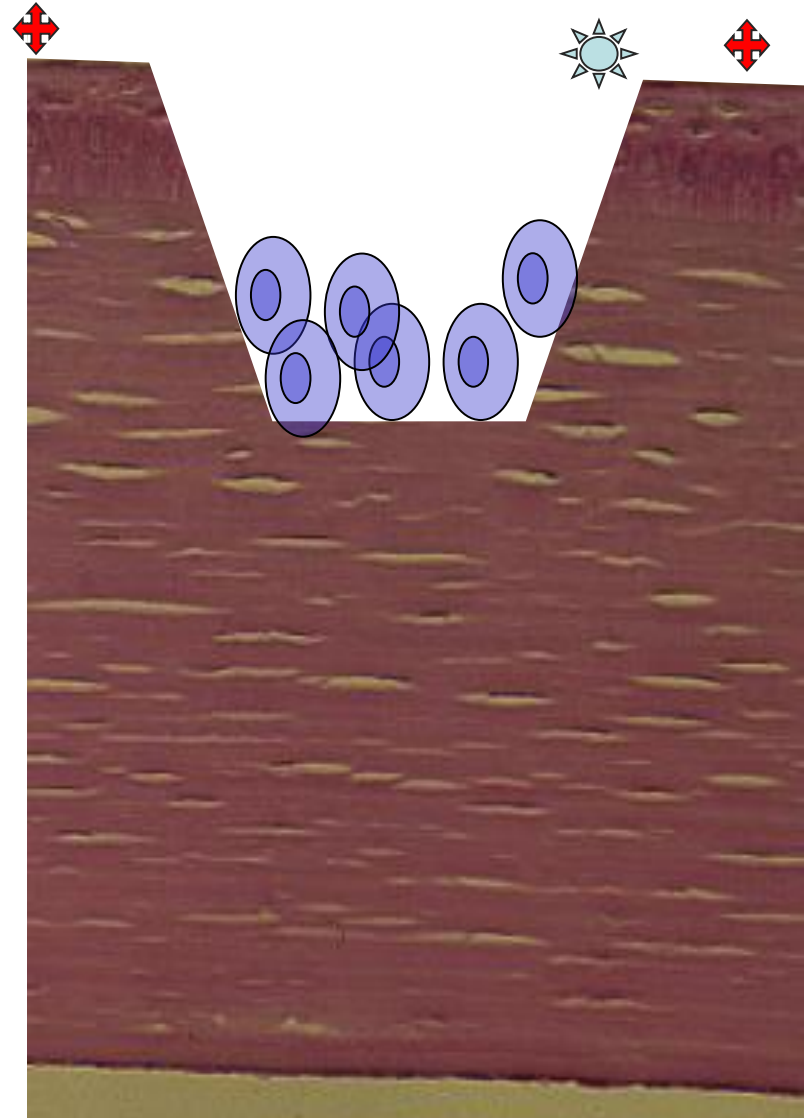
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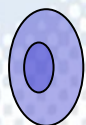
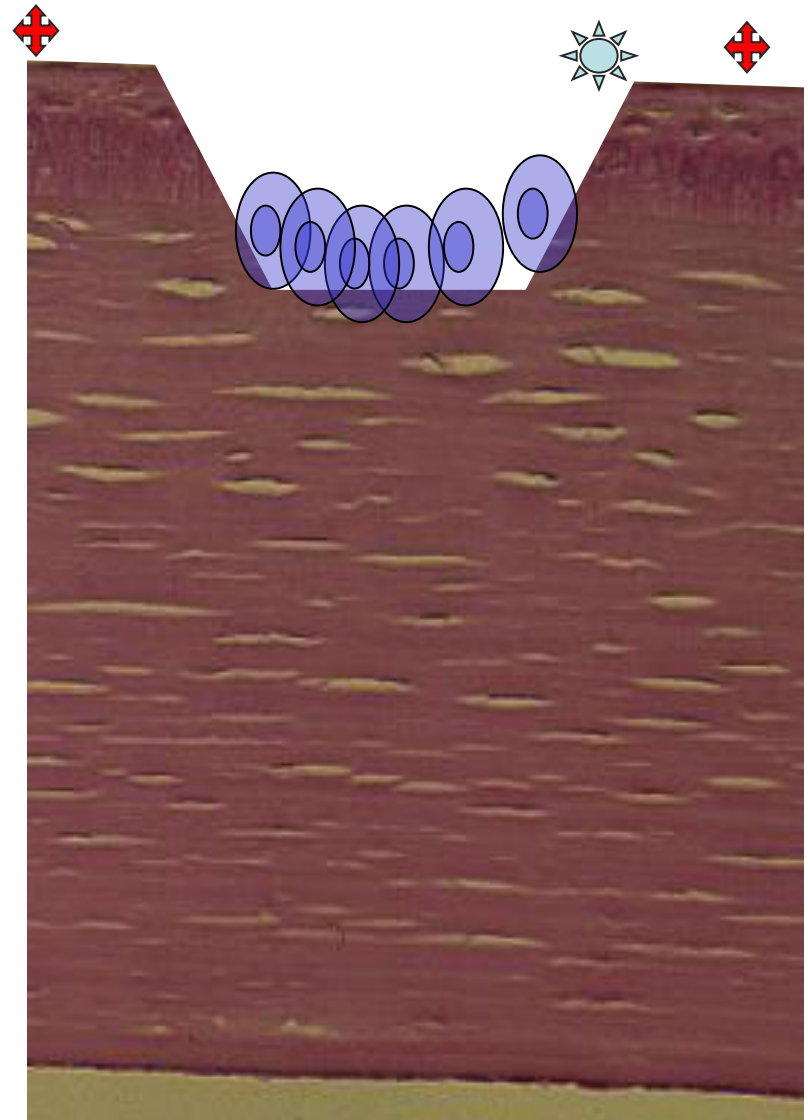
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Cytokines



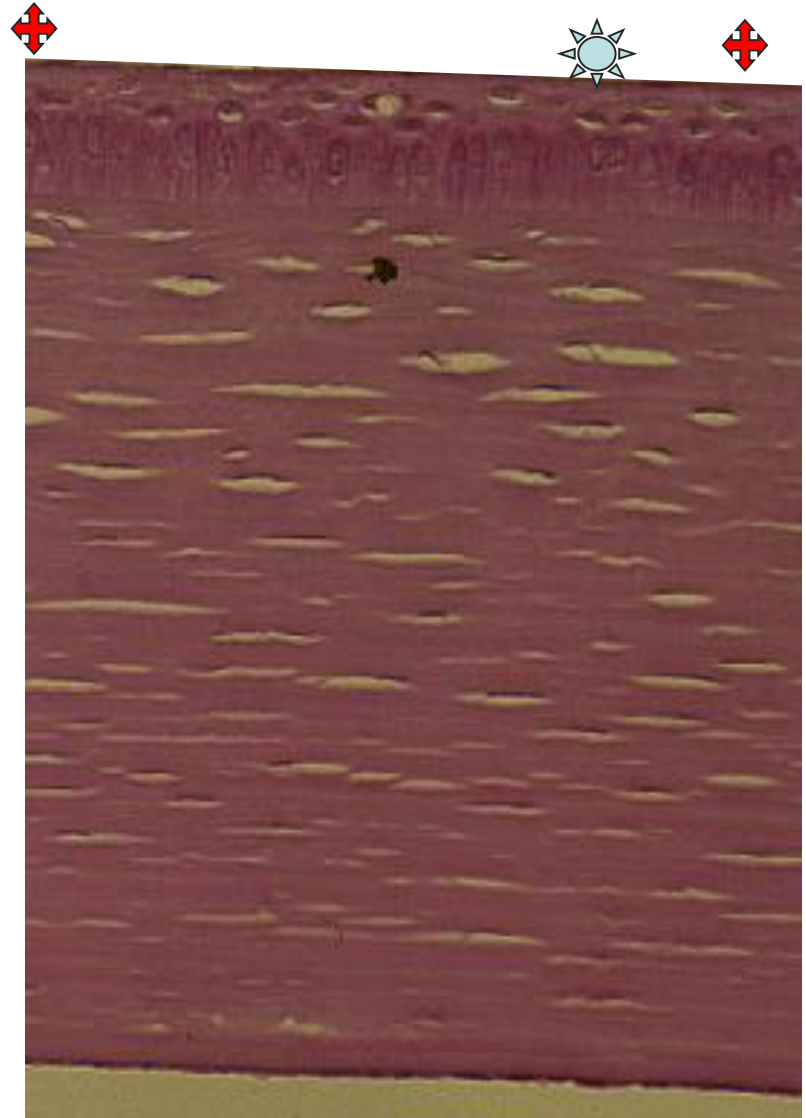
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Bacteria

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Cytokines



MMP's



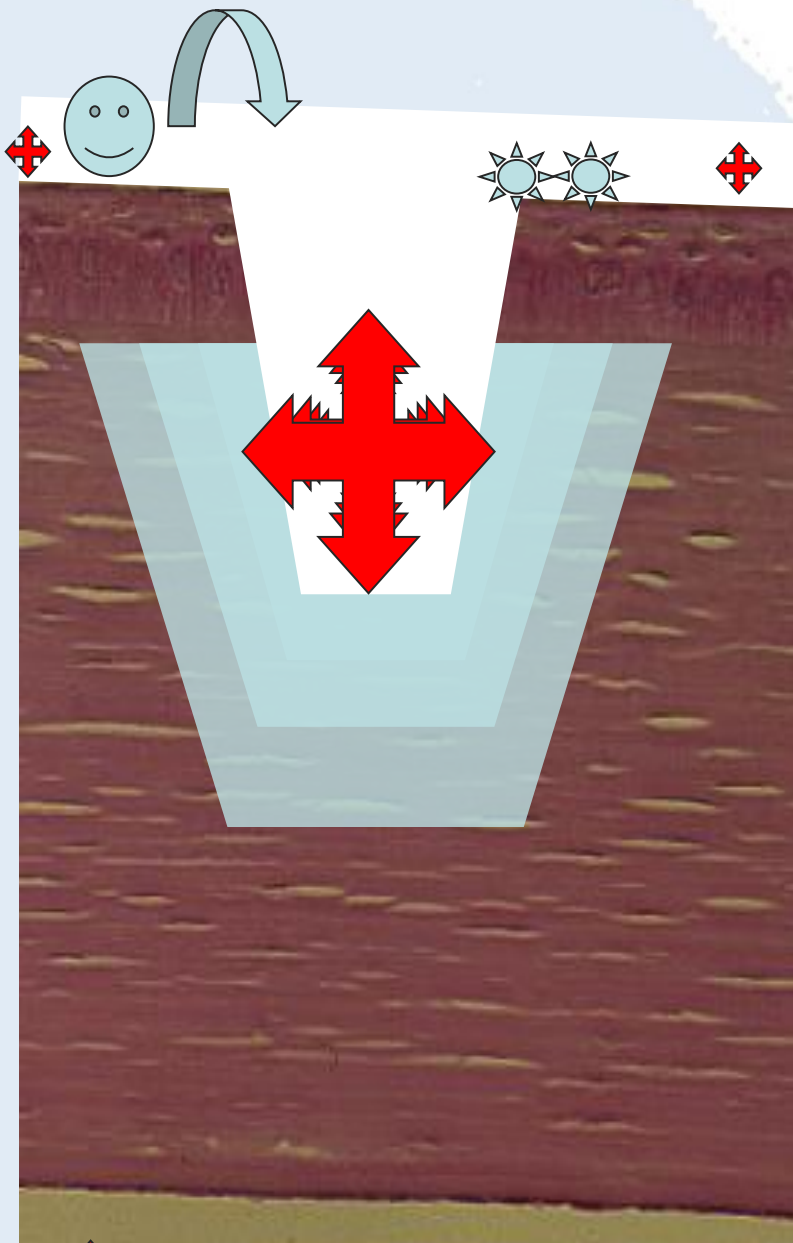
Bacteria



When **stromal** repair goes wrong:

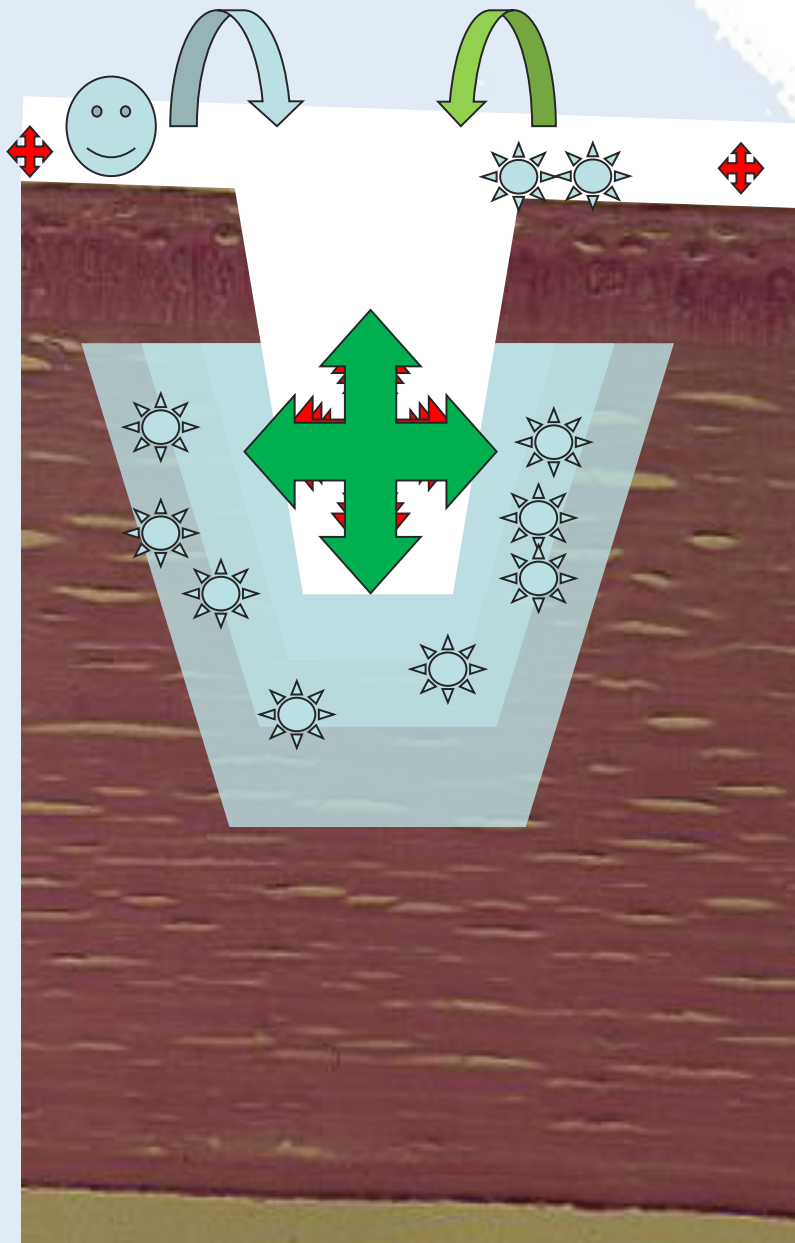
# MELTING ULCERS

# Melting ulcer (sterile)



MMP's      Bacteria

# Melting ulcer (bacterial)



 MMP's

Bacteria 

Bacterial protease 

# Treatment of melting ulcers

- Culture and cytology
- Lavage system
- 3<sup>rd</sup> generation Fluroquin's q 2hours (Ofloxacin)
- Atropine
- Serum as often as possible
- Systemic NSAID's and doxyclyne
- Consider early keratectomy to debulk necrotic tissue
- Other anti-proteases
  - EDTA, acetyl cysteine





When **stromal** repair fails

# **STROMAL ABSCESS**

# Stromal abscesses.

Needs:

Break in epithelium

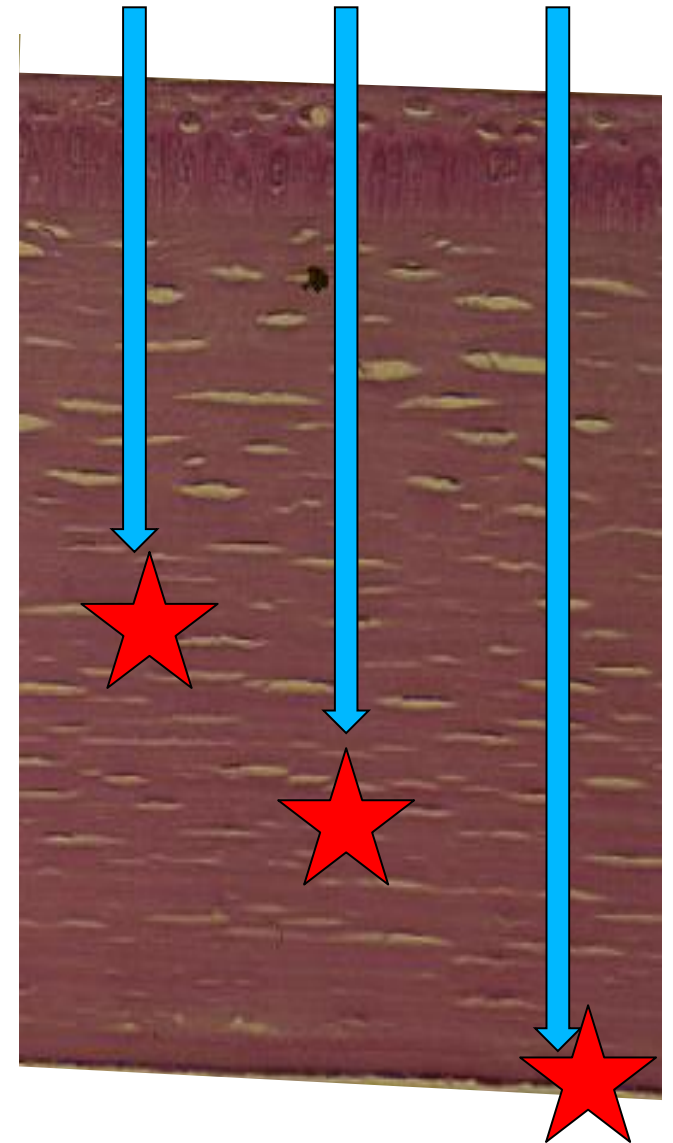
Infectious agent

Predispose by:

Micropuncture

Chronicity

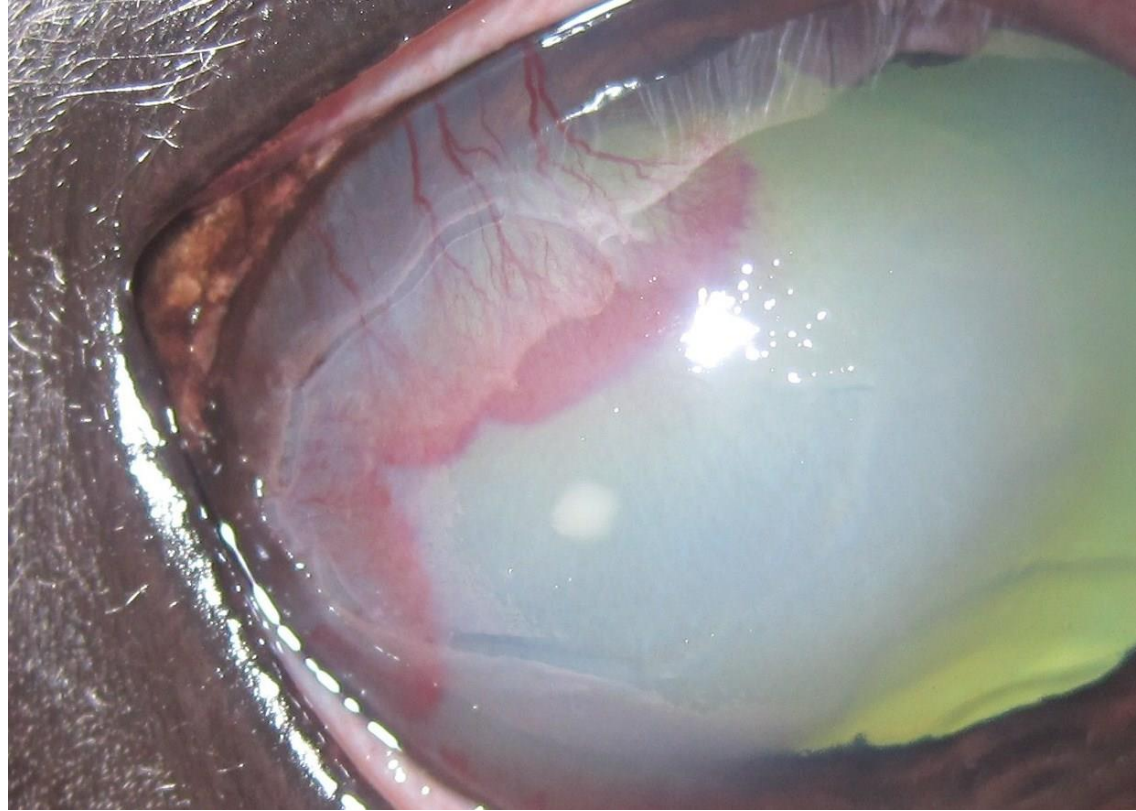
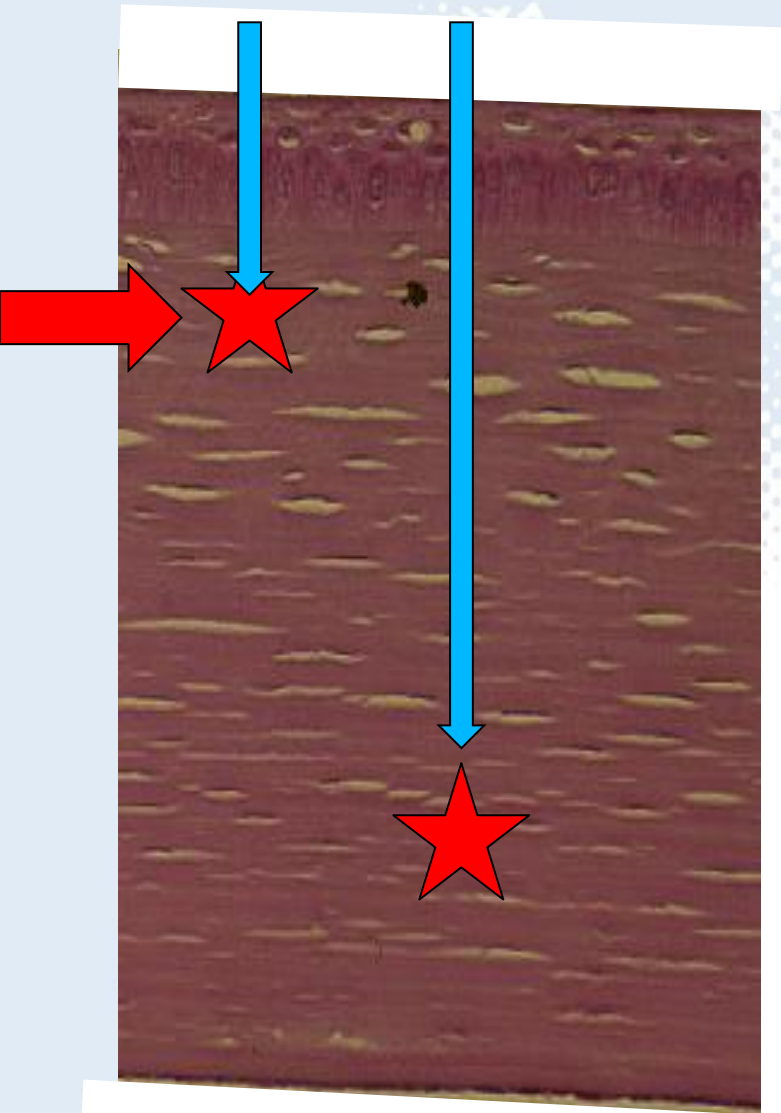
Immune- suppression  
(steroids)



# Stromal abscesses.

- Focal yellow to white lesions *within corneal stroma*
- Chronic
- Vascular response variable
- Bacterial or fungal
- Fungal hyphae love descemet's
- A surgical disease





# “Non ulcerative” keratopathies (NUK's)

Chronic (> 3 mos in duration)

Non ulcerative

Mild to moderate discomfort

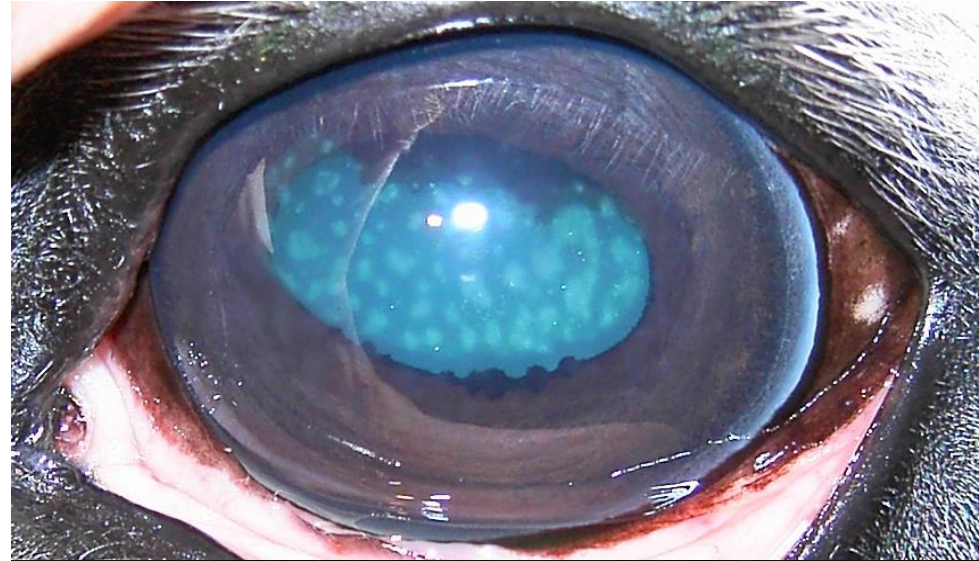
None or minimal uveitis

Wax and wane

Primary clinical sign:

“cornea cloudiness”

Vascularization



# Immune-Mediated Keratitis: Dx & Tx

History & appearance

Cytology

(lymphocytes or eosinophils)

Rule out infectious organisms  
& neoplasia

Cytology

Culture (?virus isolation)

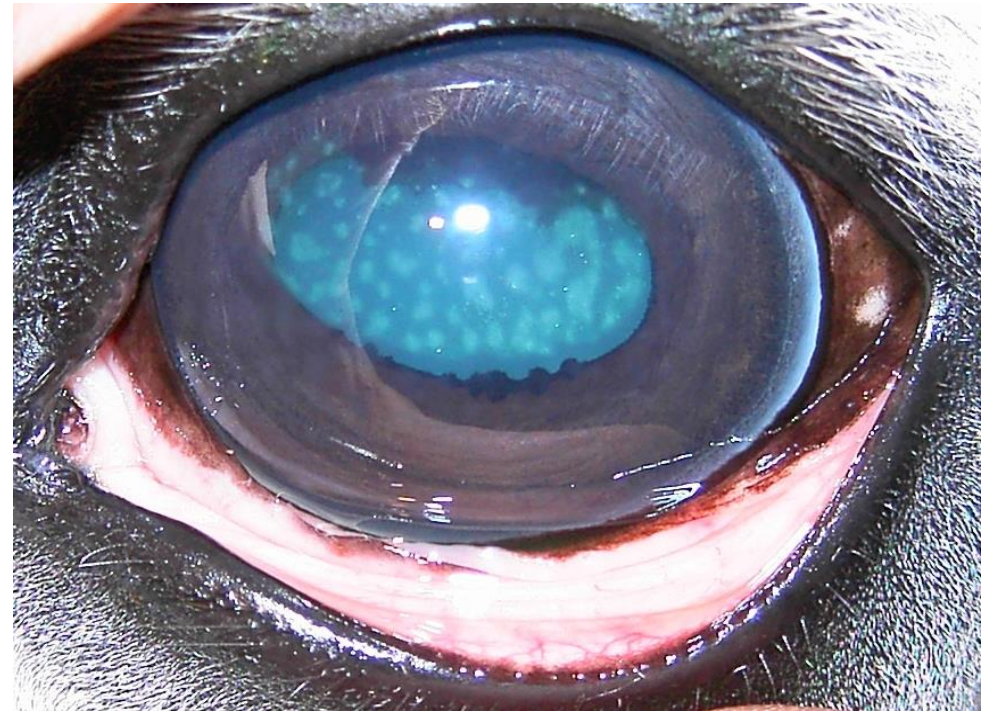
Corneal biopsy (Histopath)

Treatment

Topical steroids

Cyclosporine (malignant transformation)

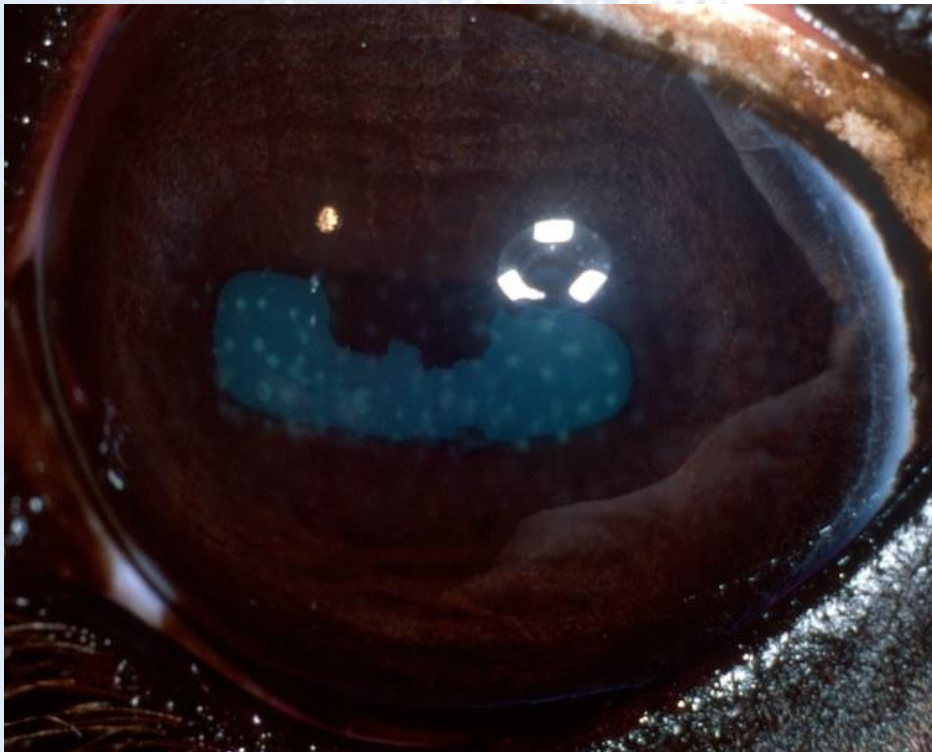
Prognosis type dependent



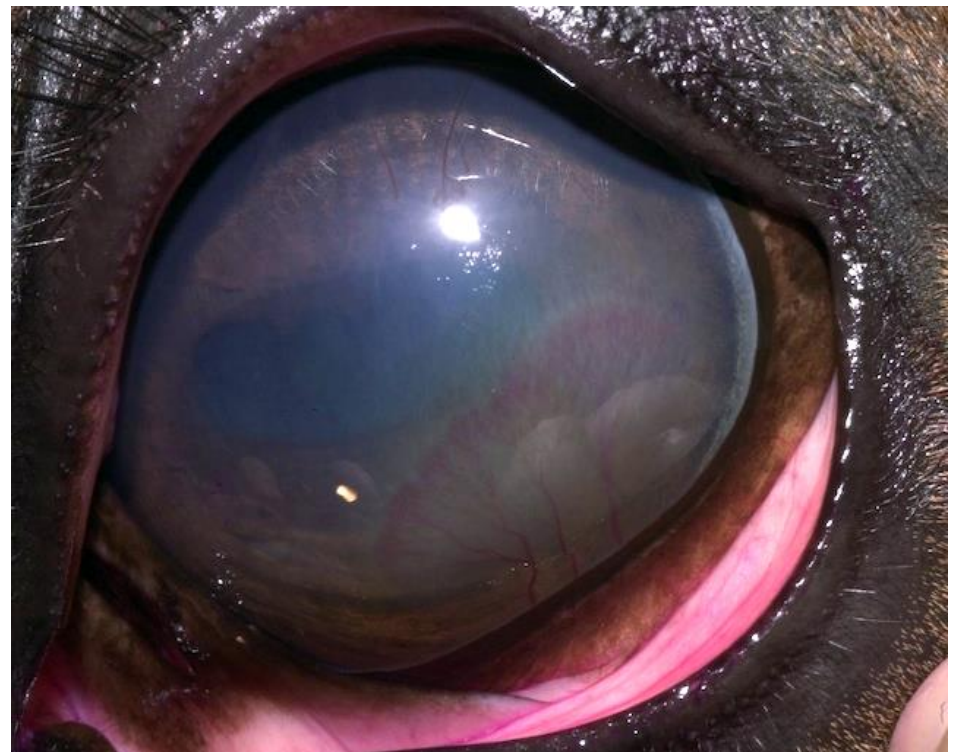
Matthews AG. Nonulcerative keratopathies in the horse. *Equine Veterinary Education* 2000; 12: 271-278.

Gilger BC, Michau TM, Salmon J. Immune-mediated keratitis in horses: 19 cases (1998–2004). *Vet Ophthalmol* 2005; 8(4):233-239.

**1. Superficial Punctate (Epithelial keratopathy): R/o herpesvirus & tear film abnormalities**



**2. Superficial Stromal**



Matthews AG. Nonulcerative keratopathies in the horse. *Equine Veterinary Education* 2000; 12: 271-278.

Gilger BC, Michau TM, Salmon J. Immune-mediated keratitis in horses: 19 cases (1998–2004). *Vet Ophthalmol* 2005; 8(4):233-239.

### 3: Mid/deep Stromal

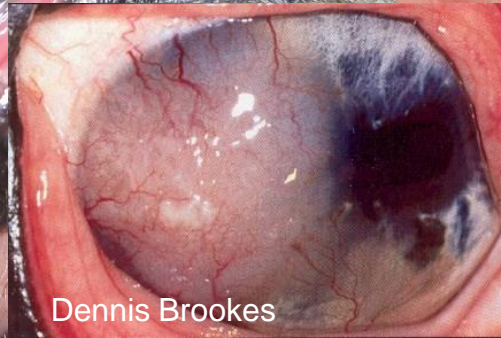


### 4. Endothelialitis



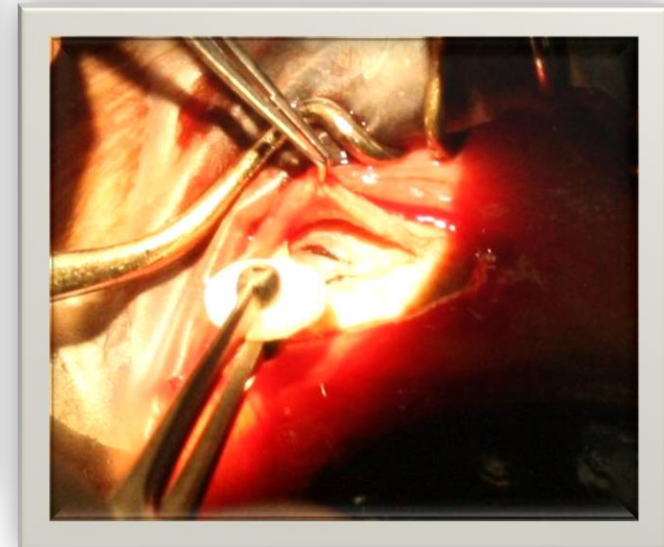
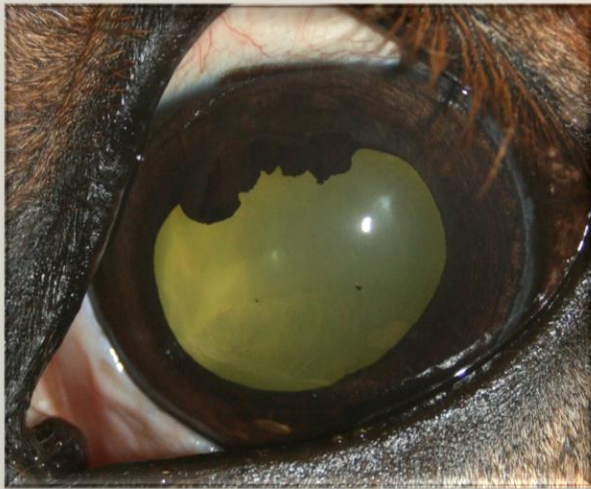
**5. Eosinophilic keratitis:  
Proliferative**

**5. Eosinophilic keratitis:  
Feline**



Dennis Brookes

# EQUINE UVEITIS



# The Uveal tract

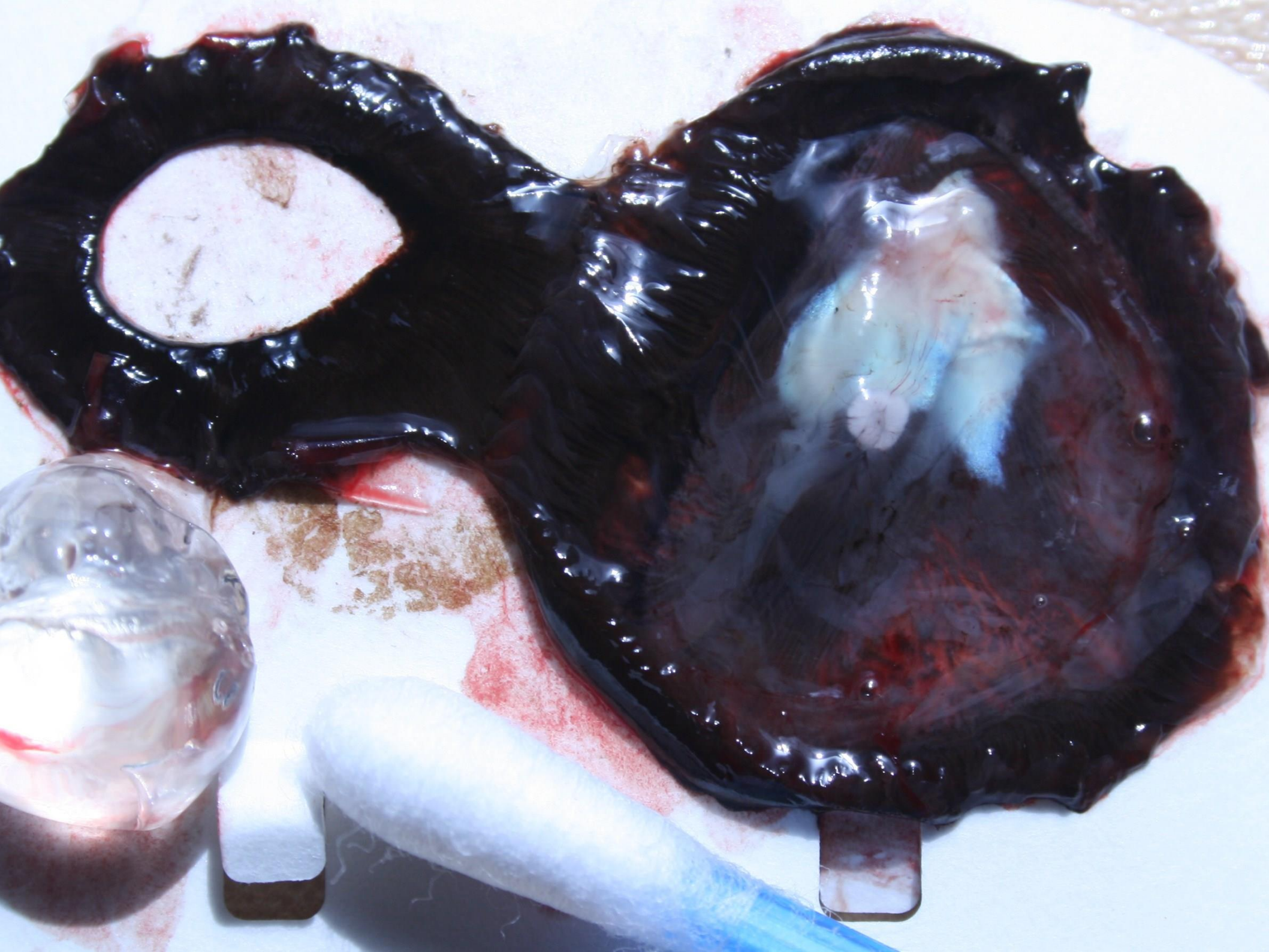


Uva



Galen AD129-216

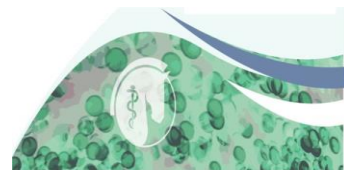




## The new equine uveitis paradigm

*Our understanding of the ocular immune system is changing rapidly which is leading to a reinterpretation of disparate syndromes of intraocular inflammation, including those which have historically been considered as ERU .*

***A new paradigm is arising where the lines between classical ERU and other forms of chronic and recurrent ocular inflammation are becoming increasingly blurred.***



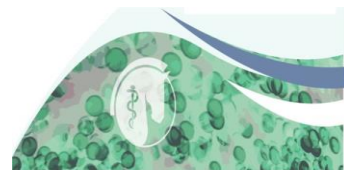
# “Classical ERU” – does it exist?

## “Then”

- Classically ERU is described as a syndrome of recurrent episodes of acute anterior uveitis with periods of asymptomy.

## now

- It is now generally recognized that these eyes are undergoing long term (lifelong) inflammatory processes with the acute episodes being the trigger for presentation to the clinician.
- *ERU is best considered an acute on chronic inflammatory disease driven in many cases by self recognition of antigen, an autoimmune disease.*



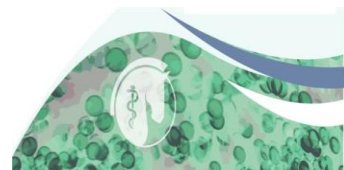
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**Probably.....**



[www.EquineOphtho.org.uk](http://www.EquineOphtho.org.uk)

Edinburgh, Scotland, EU - 2023

 **2023 IEOC Equine Ophthalmology  
Symposium  
Edinburgh, Scotland  
June 1-3, 2023**



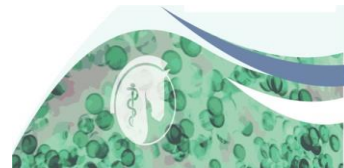
Uveitis is not always  
recurrent

Uveitis is not always  
obvious

Look for a cause

ERU is a dx of  
exclusion – don't be  
afraid to challenge it

Avoid long term  
topical steroids



# The eye is an immune privileged site

Limited immune cell entry

NO lymphatic drainage

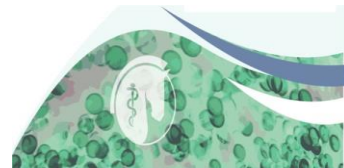
**Active** immune tolerance to foreign antigens Anterior chamber acquired immune deviation (ACAID)

## Sir Peter Medawar

The father of organ transplantation.

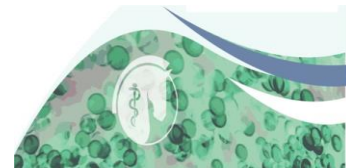
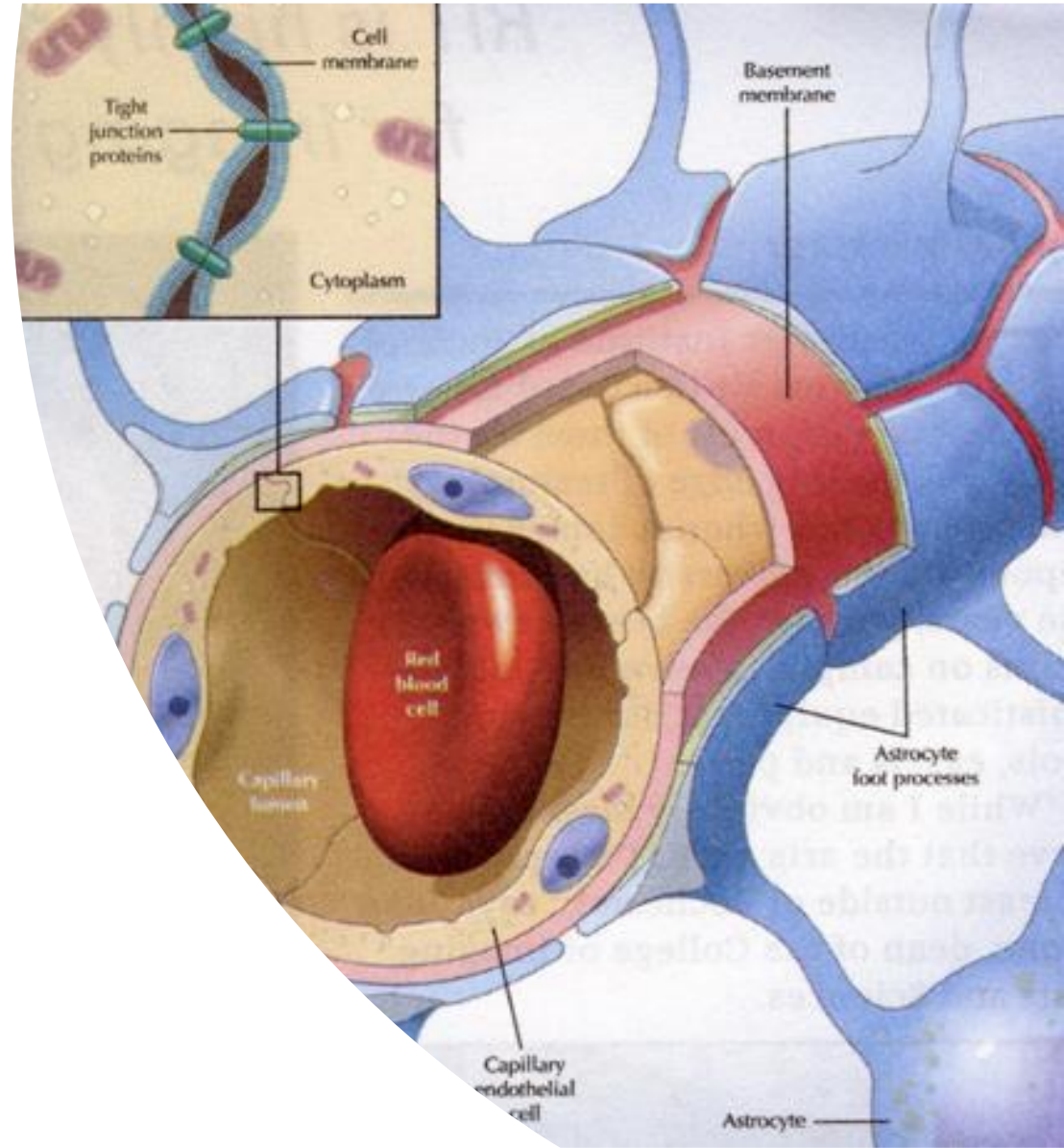


**Nobel prize 1960**



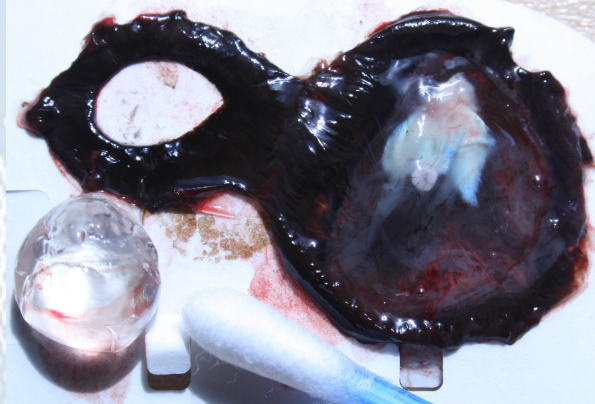
# Blood ocular barrier – the key to immune privilege

- Limited immune cell entry
- NO lymphatic drainage
- **Active** immune tolerance to foreign antigens  
*Anterior chamber acquired immune deviation (ACAID)*
- **Atropine** has been shown to narrow **tight junctions** present between endothelial cells of **capillaries**

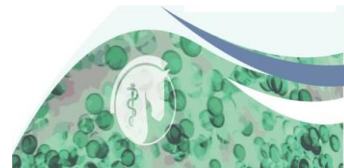


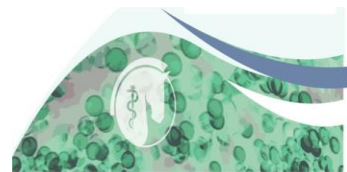
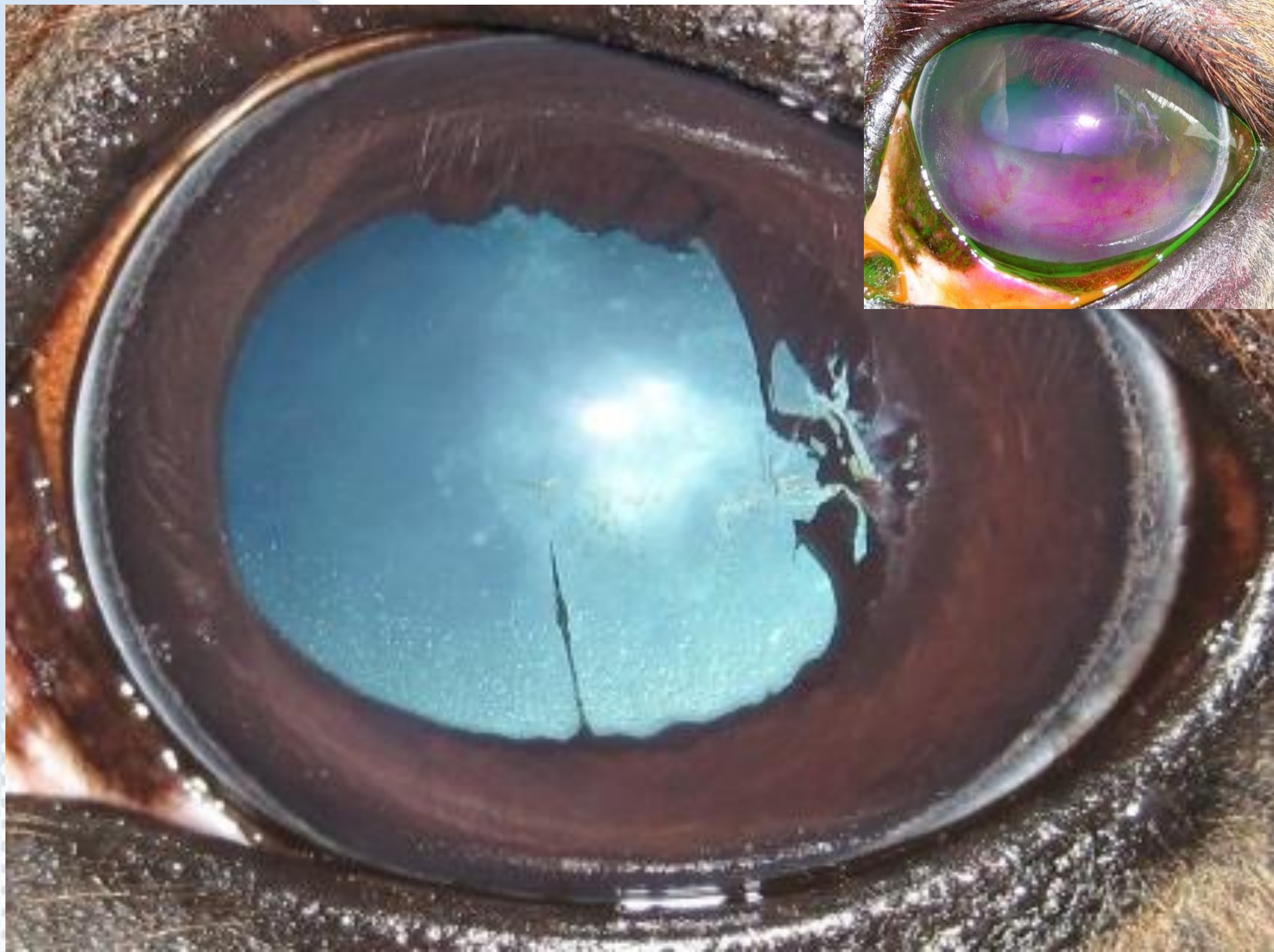


Uva



Uveal tract inflammation not just “uveitis”

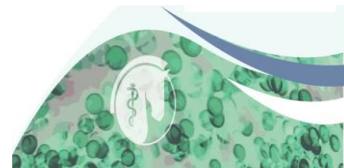
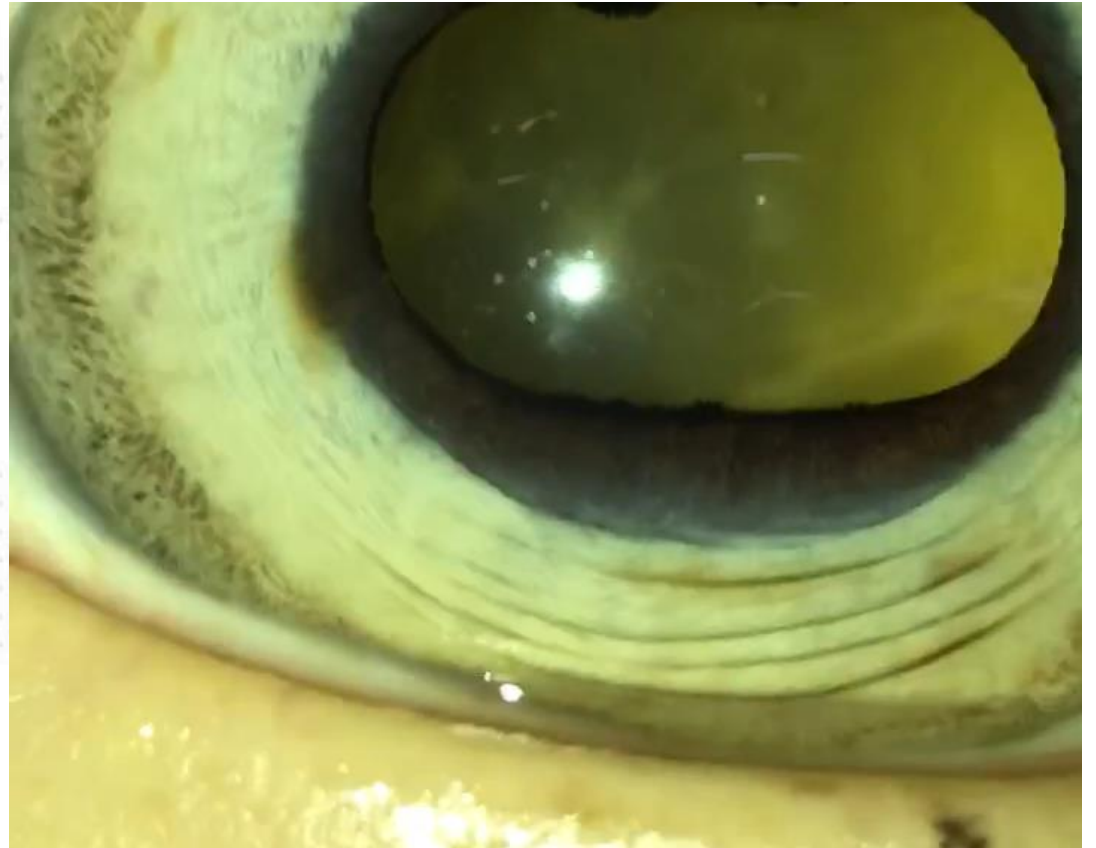




# Vitreous

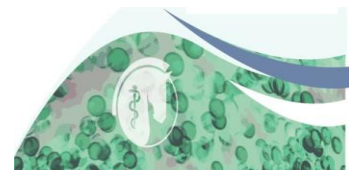
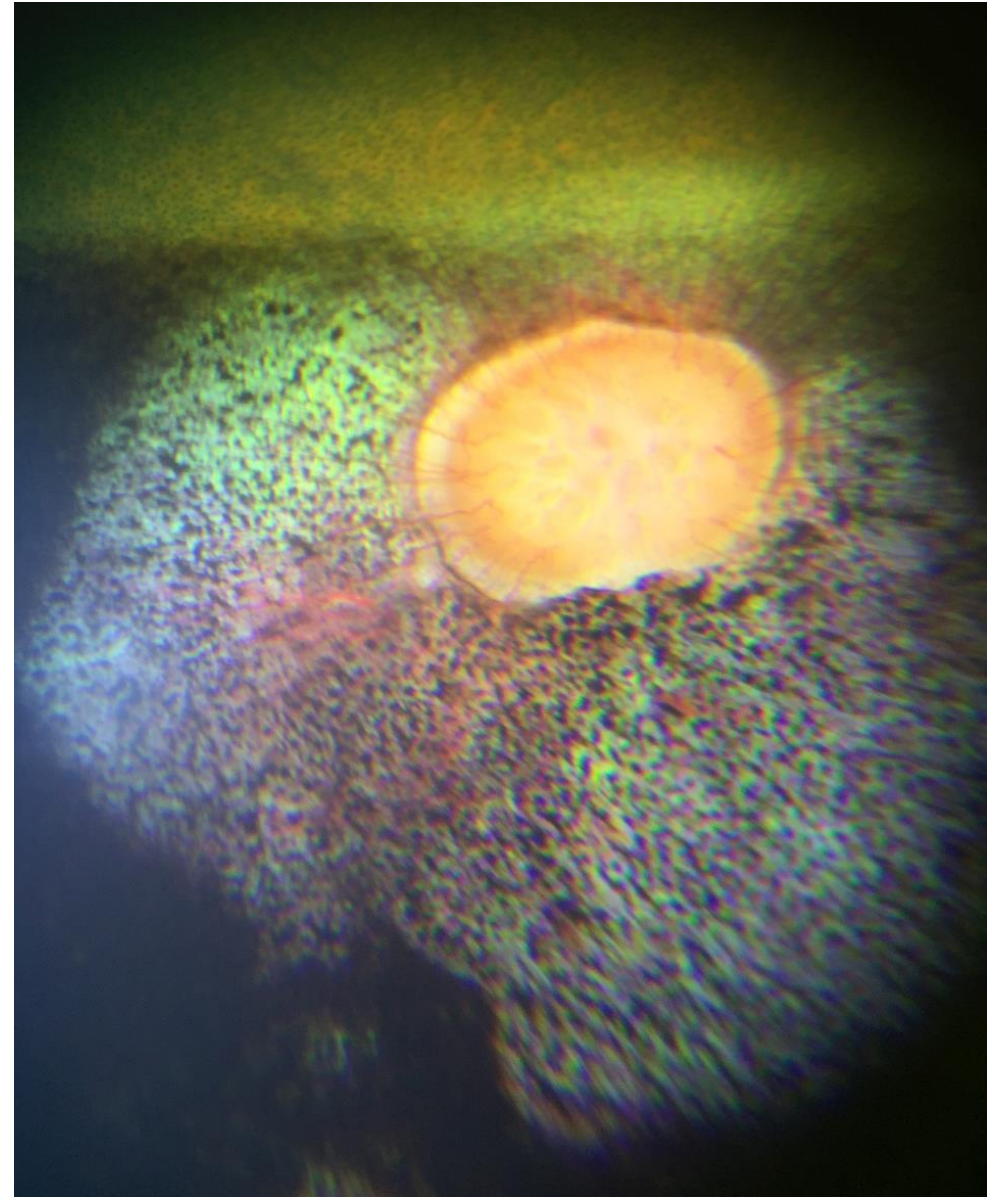
Start at vitreal base, 4 angles

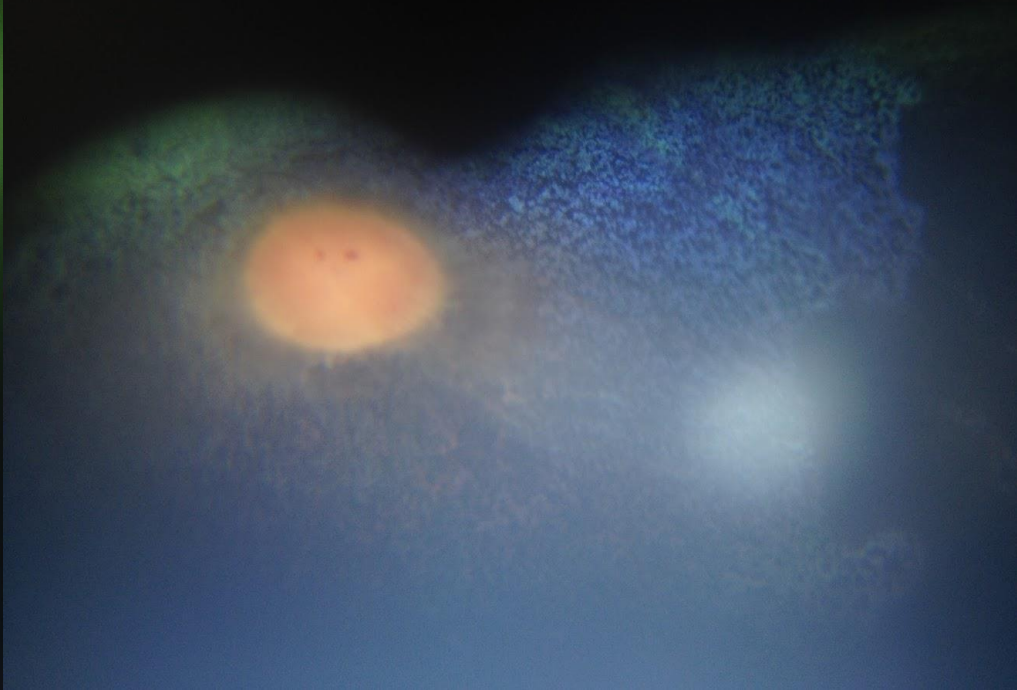
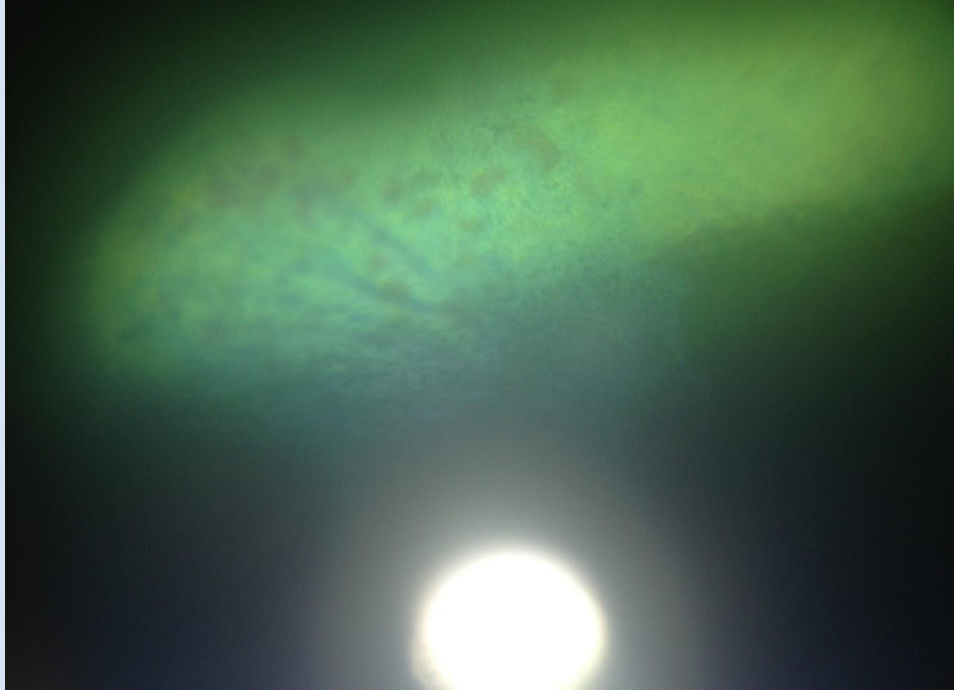
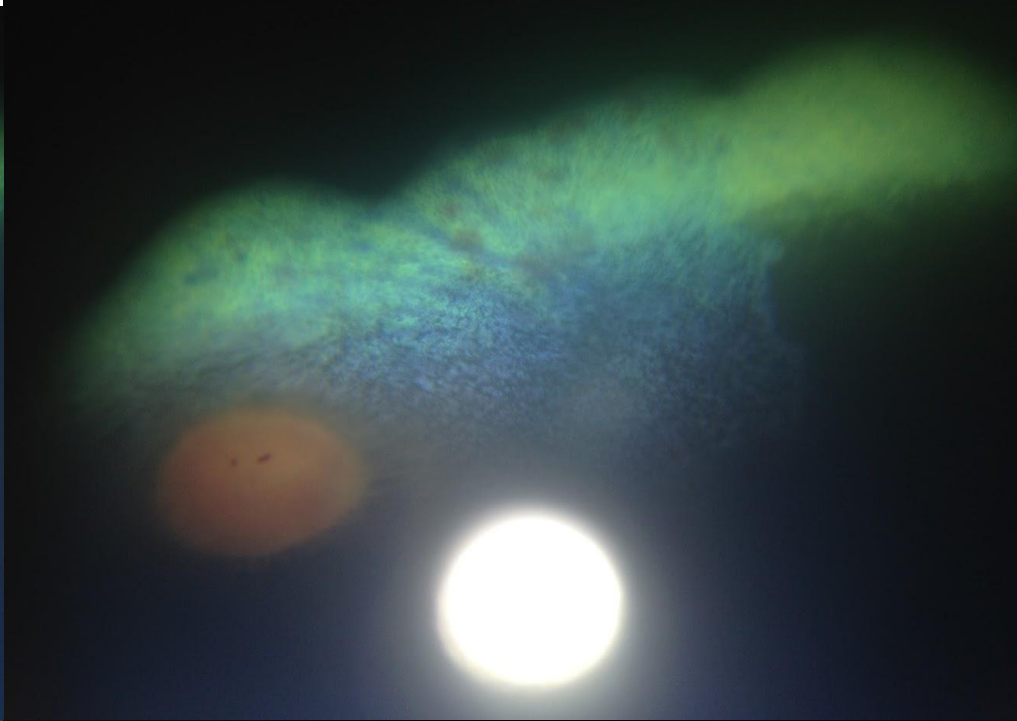
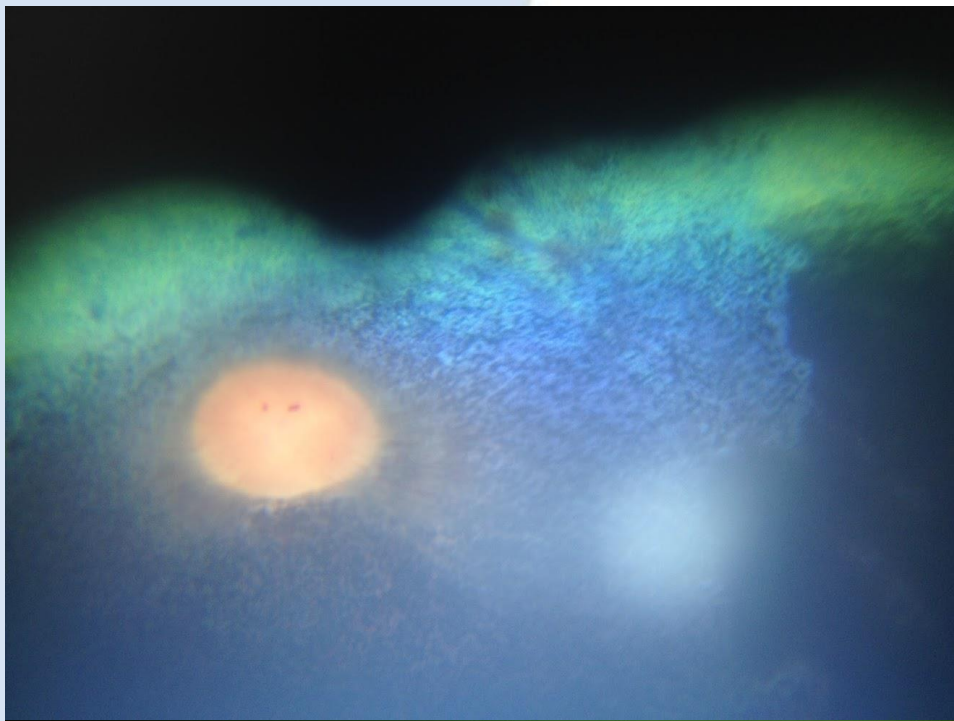
Video often helpful to document opacities

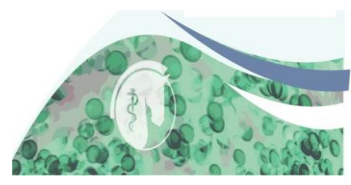


# Posterior inflammatory changes

Bullet & Butterfly lesions



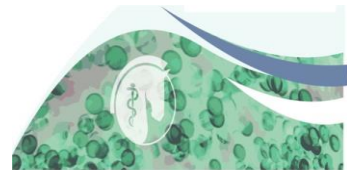






## Uveitis is like laminitis

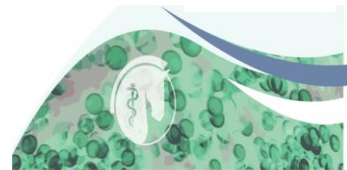
- many triggers
- mechanisms uncertain
- bad news for the eye
- Each horse responds differently
- variety of visually important sites within the eye can be affected
- uveitis is not necessarily recurrent
- uveitis is not always obvious





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# Causes of the **first** episode of uveitis?

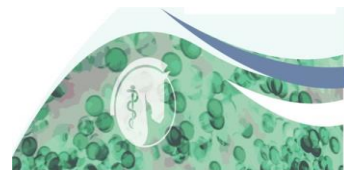
## External trauma

- Sharp trauma (corneal perforation.)
- Blunt trauma
- Bystander damage from adjacent inflammation (Melting ulcer, stromal abscess etc)

## Systemic disease or “blood born trauma”

Any cause of :

- septicemia
- bacteremia
- thromboembolic disease
- toxemia



# Acute uveitis

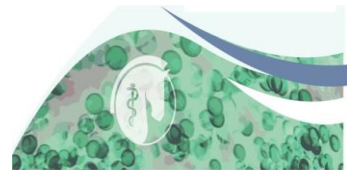


Ophthalmic catastrophe

Resolution

Chronic uveitis

Equine Autoimmune Uveitis (EAU)



# Treatment of acute uveitis



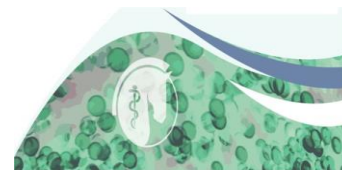
**Topical steroids** – as frequently as possible +/- or subconjunctival injections, ramp down quickly as responds

Systemic NSAIDS / steroids

Topical mydriatics (important) – 1% atropine to effect

**Taper for 30 days post clinical resolution**

**And look after the cornea !**



# What perpetuates uveitis?

## Continued trauma

Loss of globe integrity (leaking wounds)

Intra-ocular infection:

Acute - Bacterial infection  
(endophthalmitis)

Chronic – Leptospires

Bystander damage e.g. corneal abscess

**NB Inactive** foreign material will elicit  
no immune response in a normal eye

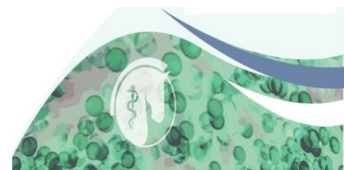
## Immune “discovery”

Lens induced uveitis

“Heritable factors”

Equine Autoimmune Uveitis

*(remember Louis Braille &  
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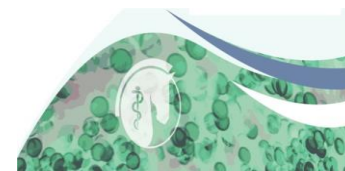
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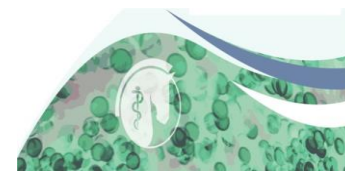
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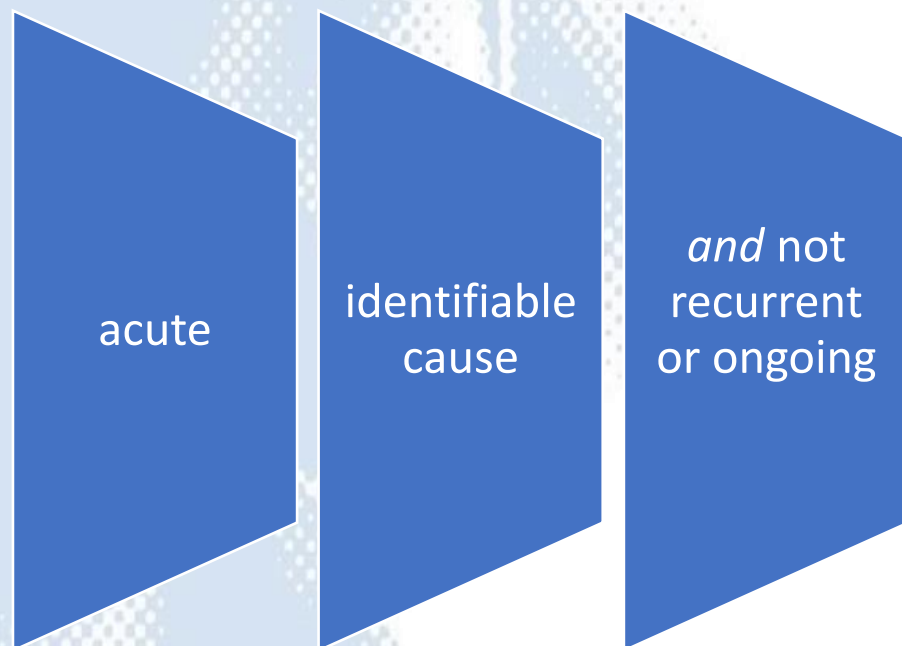
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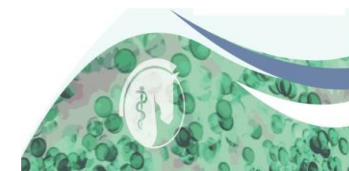
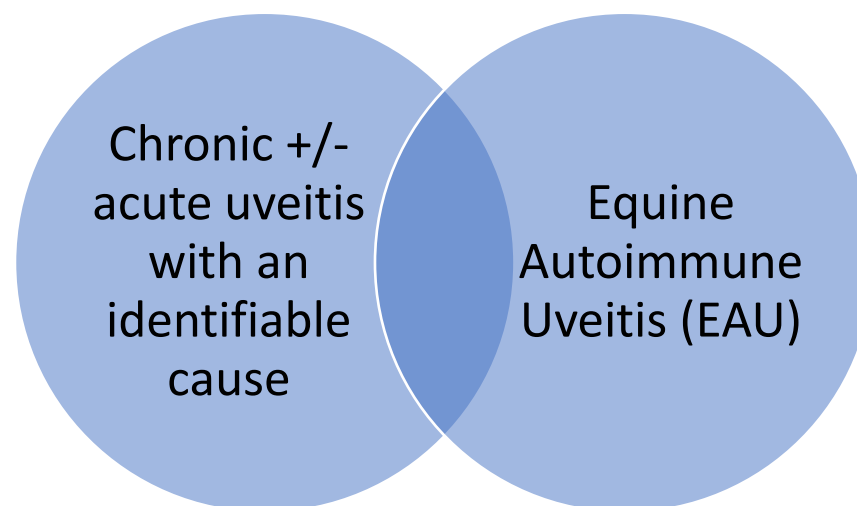


# The new equine uveitis paradigm

## Simple

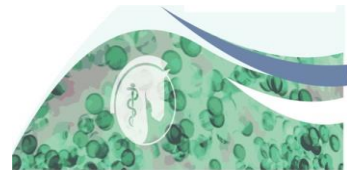


## Complex or syndromic



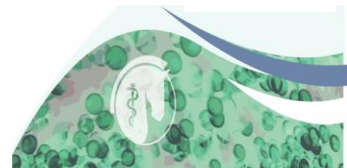
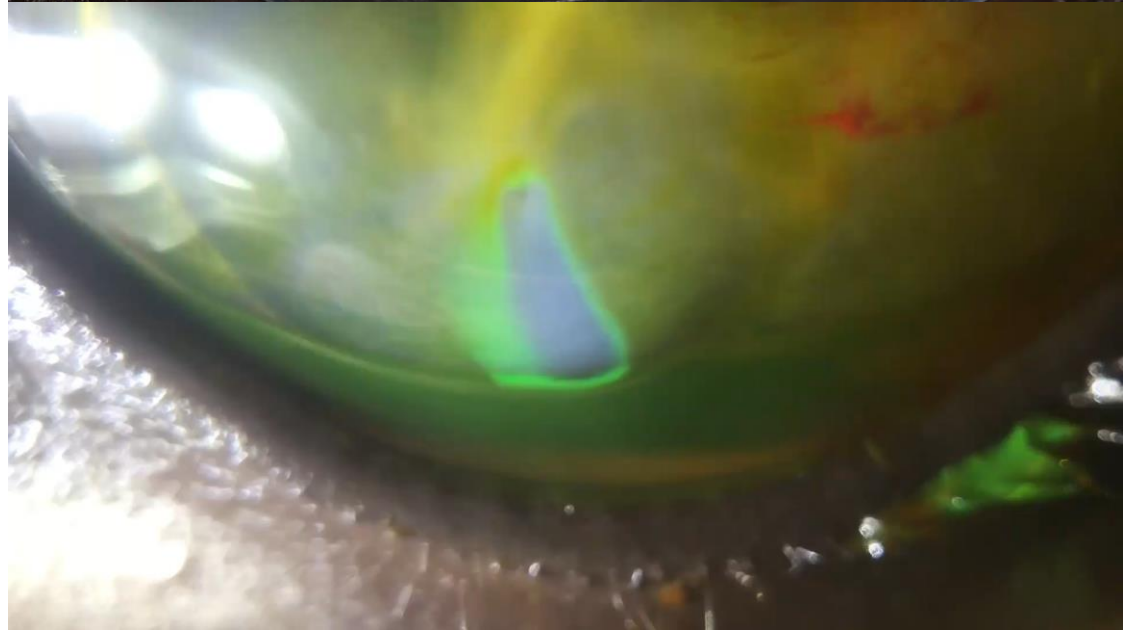
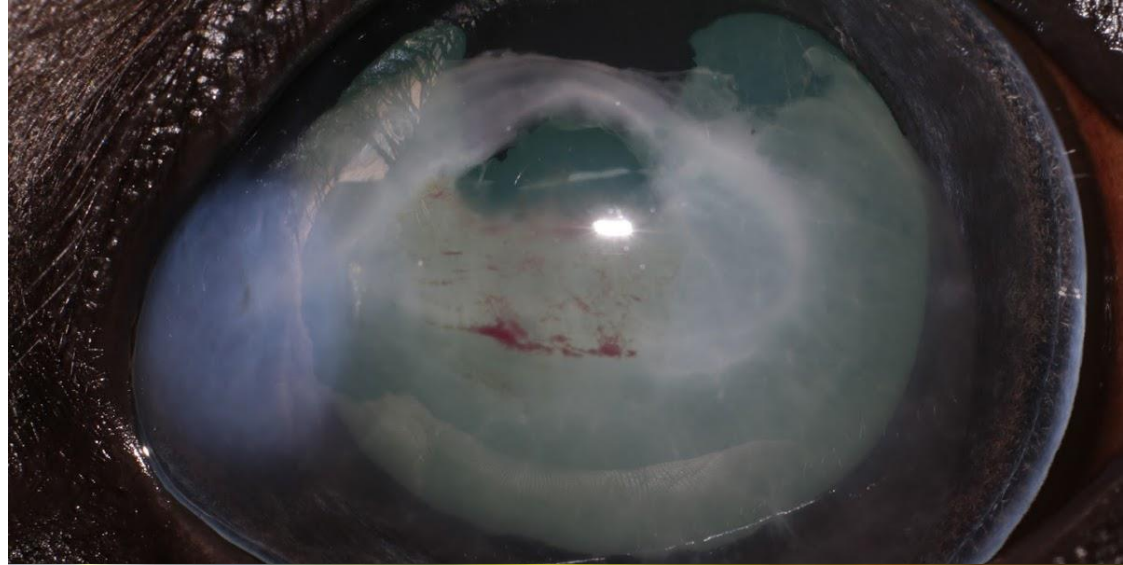
# “Simple uveitis”

- acute
- identifiable cause
- *and* not recurrent or ongoing



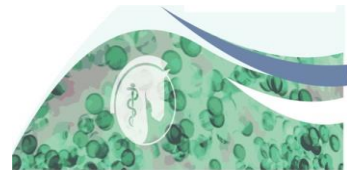
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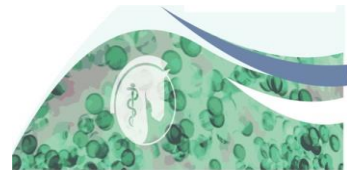
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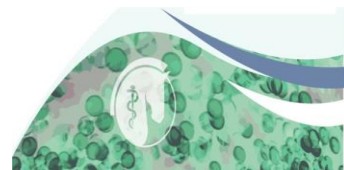
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- identifiable cause
- *and* not recurrent or ongoing



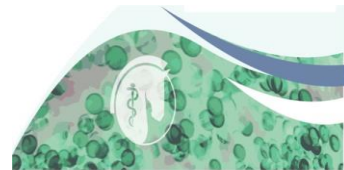
# Complex type A: Chronic uveitis – identifiable cause

- Chronic uveitis +/- acute uveitis with an identifiable cause
- *Removal of the trigger may lead to resolution*
- *May subsequently develop autoimmune uveitis*
- Causes:
  - Stromal abscess
  - Lens induced uveitis
  - Leptospiral uveitis



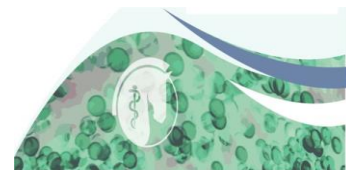
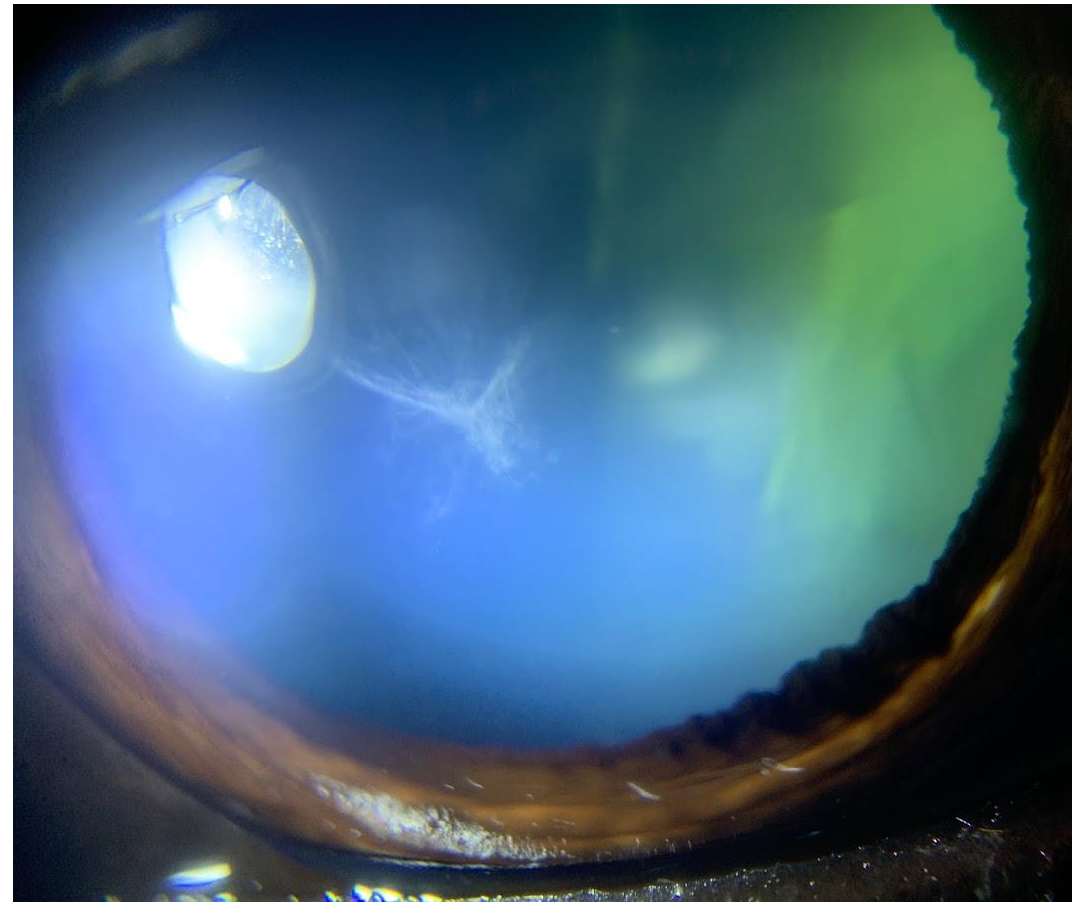
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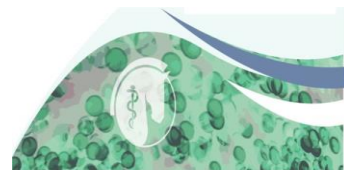
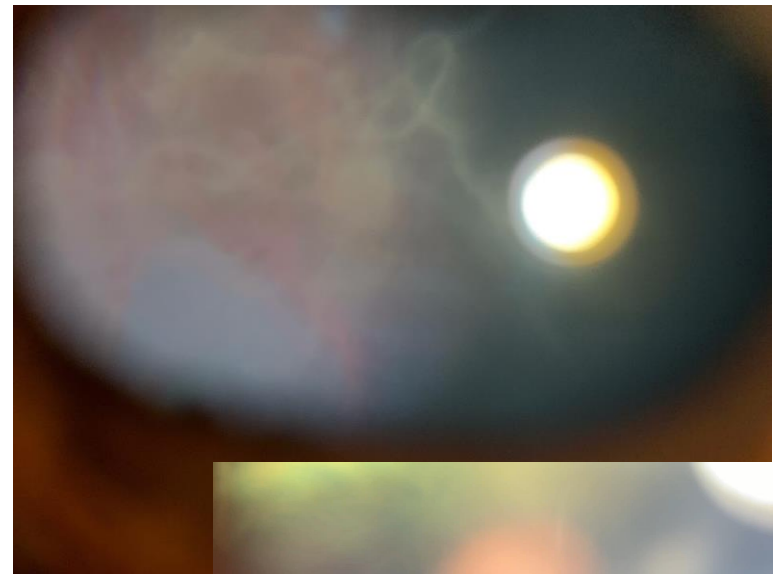
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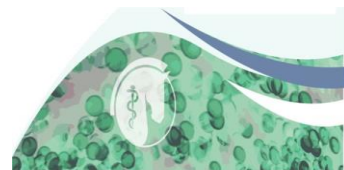
# Complex type A: Chronic uveitis – identifiable cause

- Chronic uveitis +/- acute uveitis with **an identifiable cause?**
- *Removal of the trigger may lead to resolution*
- *May subsequently develop autoimmune uveitis*



# Complex type B: Equine Autoimmune Uveitis

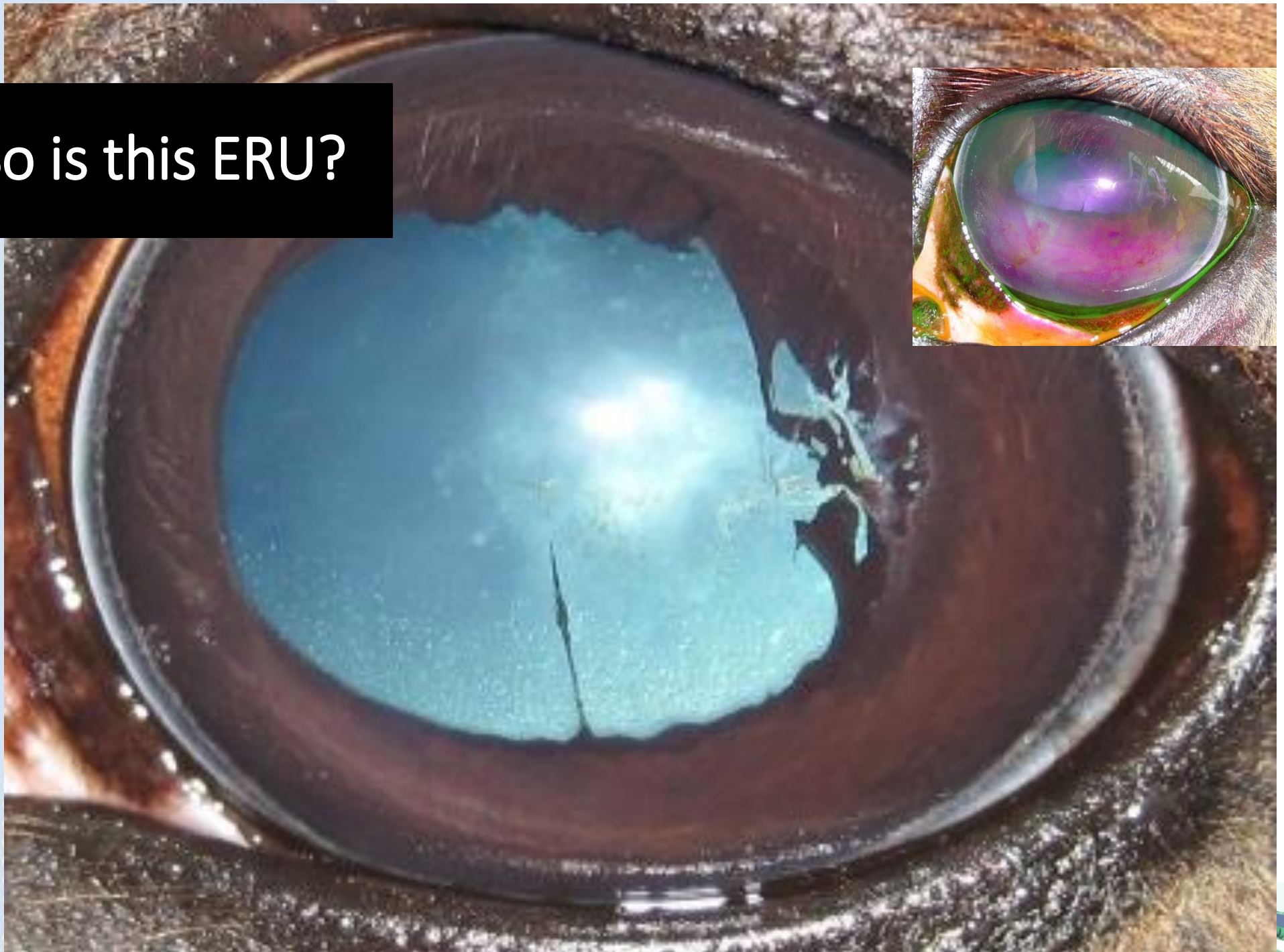
- Chronic uveitis +/- acute uveitis with no identifiable cause assumed to be due to a self-directed immune response due to breakdown of immune tolerance of the ocular structures.
- An “autoimmune” disease where resolution is unlikely. Control requires ongoing immunosuppressant therapy.
- *Resolution unlikely without ongoing treatment*
- *A diagnosis of exclusion*
- Conditions which probably represent EAU include:
  - Classical ERU
  - Insidious uveitis
  - Heterochromic iridocyclitis (and Keratiti)
  - Endothelitis ?



So is this ERU?

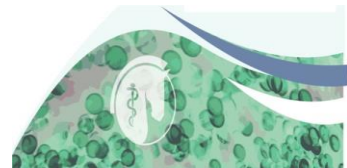


So is this ERU?



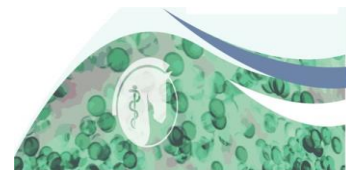
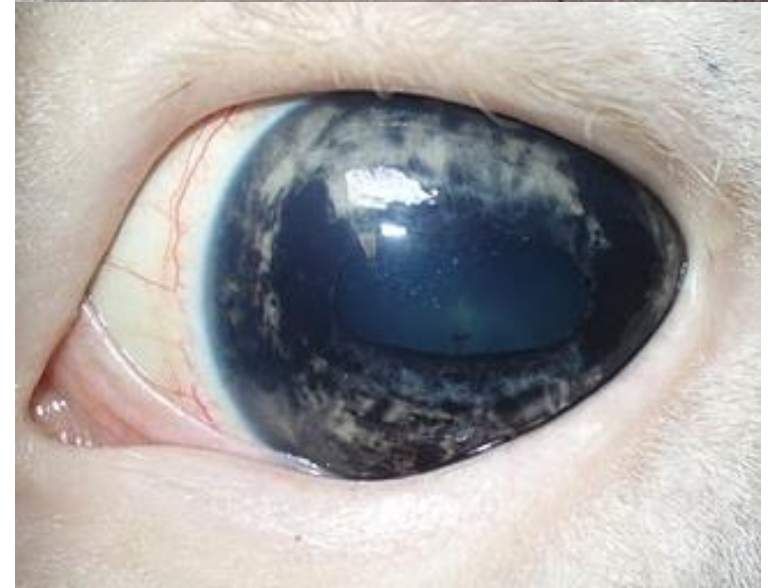
# The many faces of “ERU”/EAU

“new” clinical syndromes:



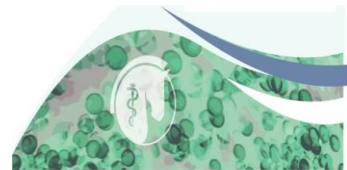
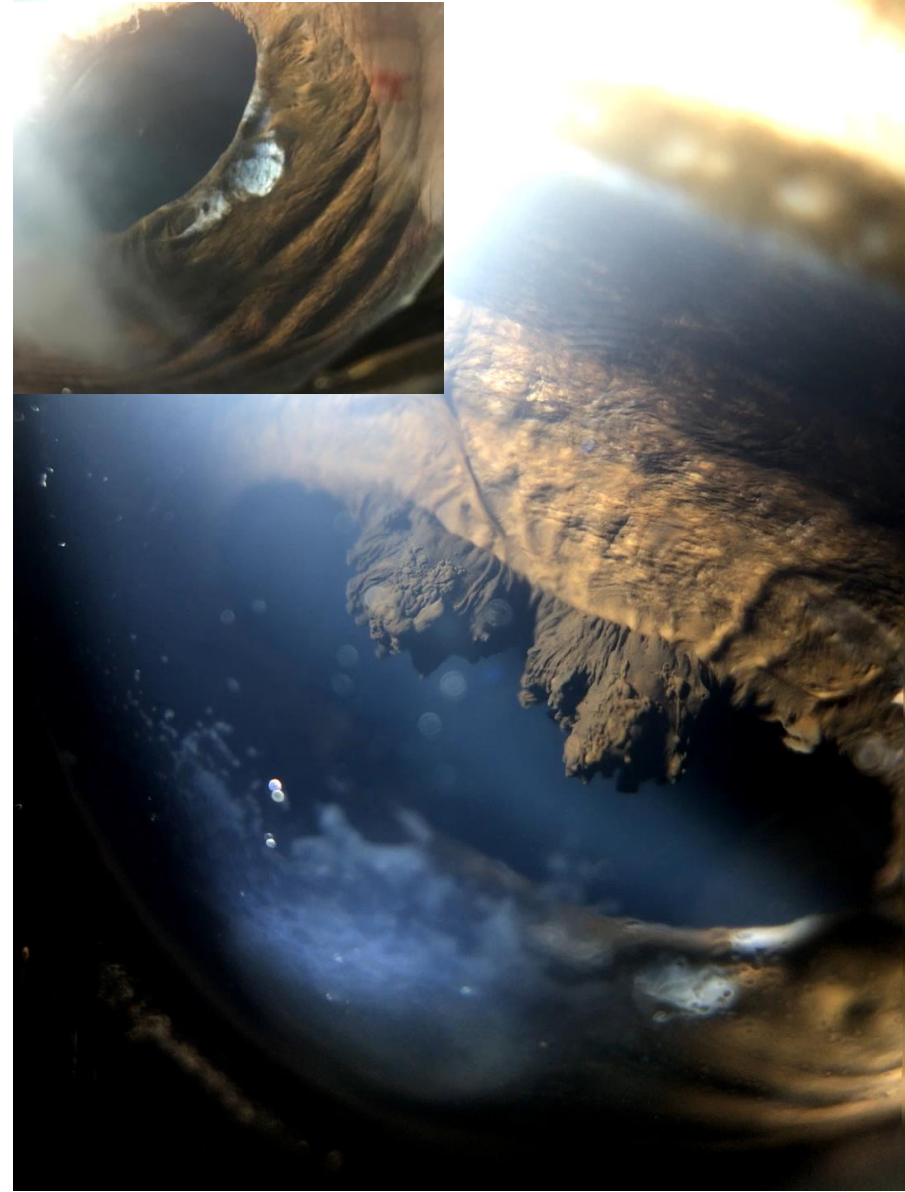
# Subclinical Uveitis: “Insidious uveitis”

- No observed bout of inflammation/pain
- “occasional watery eye”
- Eye(s) have typical signs of chronic uveitis
  - Cataract formation
  - Glaucoma
  - Retinal detachment
  - Phthisis bulbi
- Common in Appaloosa and Draft breeds
- ***Heritable (linked to coat colour)***

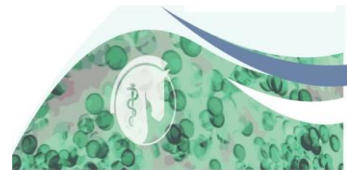


# Subclinical Uveitis: heterochromic iridocyclitis

- “Pigmentary uveitis”
- Often presents with corneal oedema / recurrent ulceration hence “Heterochromic Iridocyclitis with Keratitis” or HIK
- No observed bout of inflammation/pain
- “occasional watery eye”
- Eye(s) may have typical signs of chronic uveitis
- Plus striking iridal depigmentation



# “New” approaches to Uveitis treatment



# “New” approaches to Uveitis treatment:

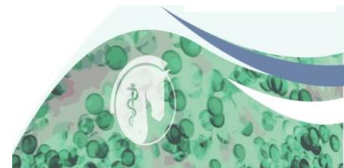
## Look after the cornea

- **Avoid** chronic use of topical steroids
- Support cornea, especially if using topicals



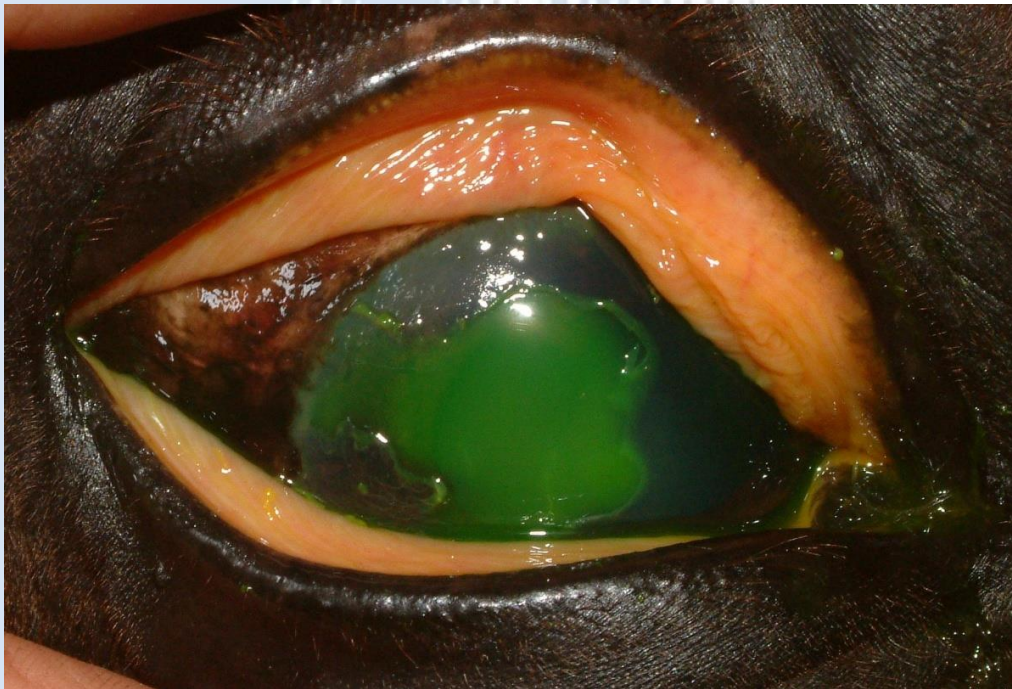
## Early “categorisation” & long term scepticism

- Simple
- Chronic with treatable cause
- Chronic with autoimmune cause or confounder (EAU)
  
- *Diagnostics vs pattern recognition*

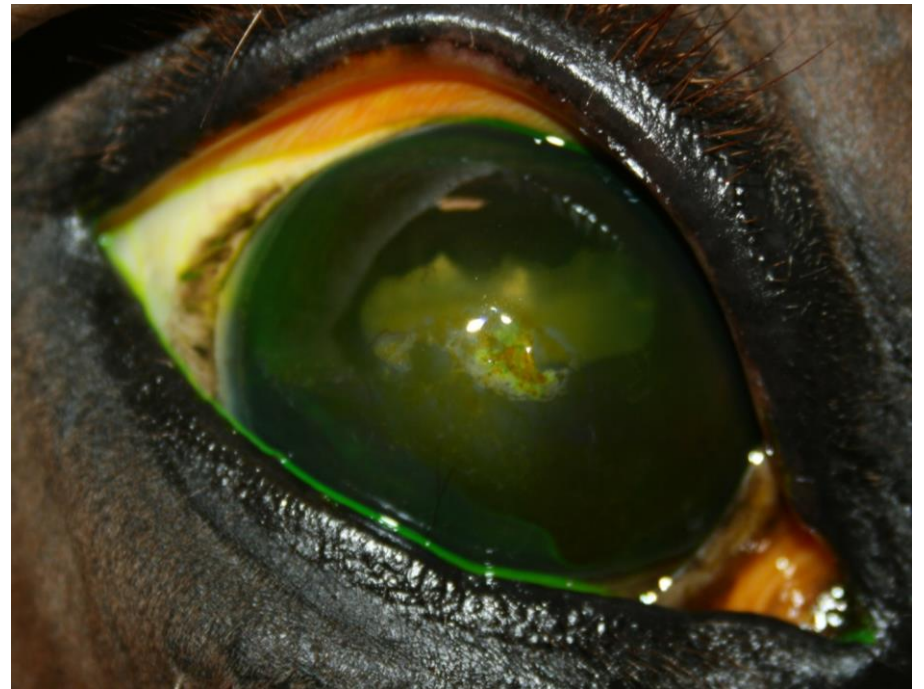


# Topical steroids “Maxitrol poisoning”

**Indolent corneal ulcers**



**Calcific corneal degeneratiokn**

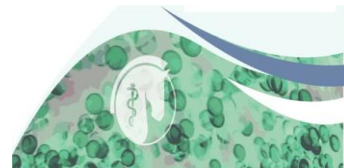


# Topical steroids “Maxitrol poisoning”

**Fungal keratitis**



**Melting ulcers**



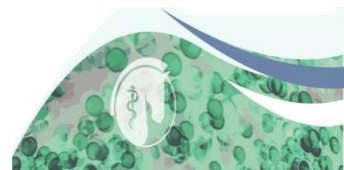
# “New” approaches to Uveitis treatment:

## Diagnostics

- Full clinical exam (SPE, inflammatory markers)
- Slit lamp examination
- IOP – glaucoma can confound
- Aqueocentesis:
  - Lepto PCR
  - Lepto serology (pair with serum)

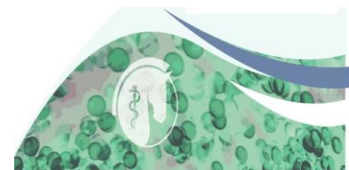
## Early “categorisation”

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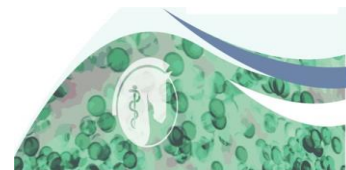
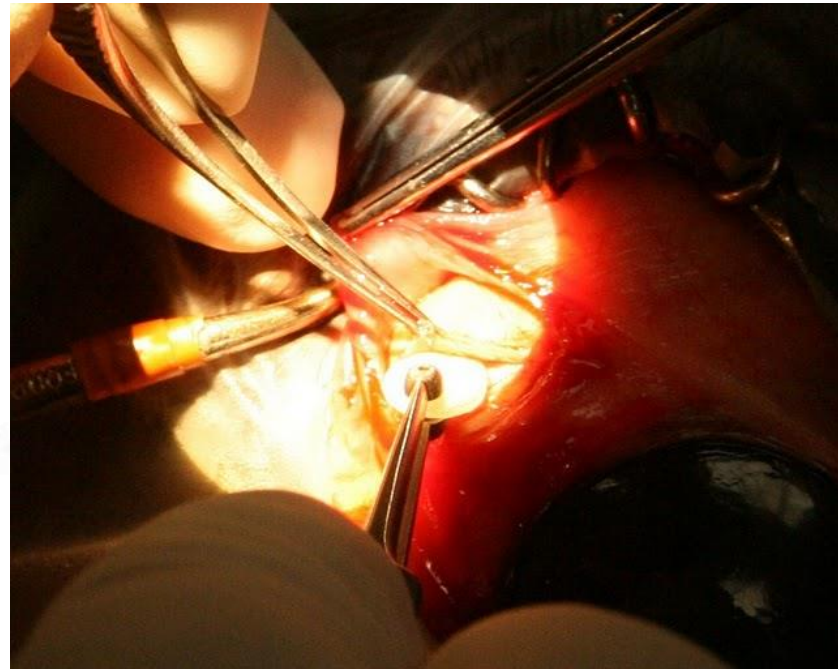
## Subconjunctival +/-or systemic steroids

- Bulbar conjunctival injections
  - match injection site to location of inflammation
  - Triamcinilone
  - Prednisilone
- Can be repeated, vary site, ware fungal keratitis
- Anecdotal evidence better for cornea
- **Oral** pred & dex

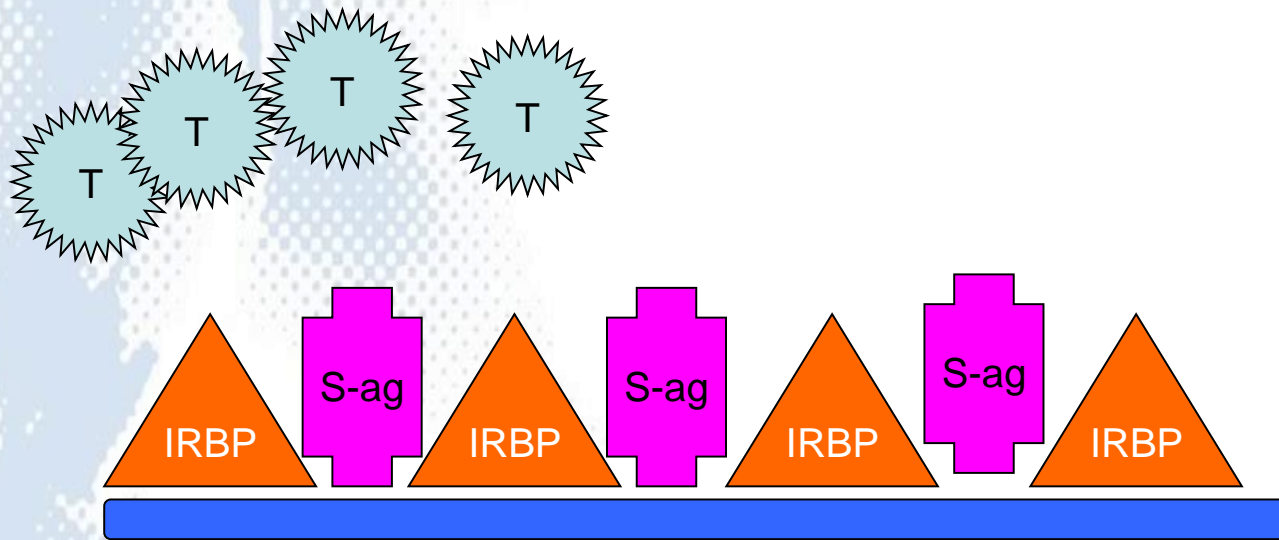


# Suprachoroidal cyclosporin implants

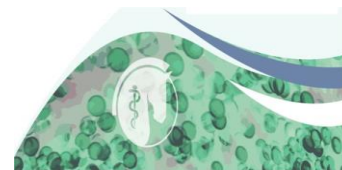
- Steroid responsive cases do best
- 30 days to reach therapeutic vitreal levels
- Last 3+ years
- 4/5 have less inflammation and attacks
- 9/10 visual at 14 months
- Some horses appear to 'cure'



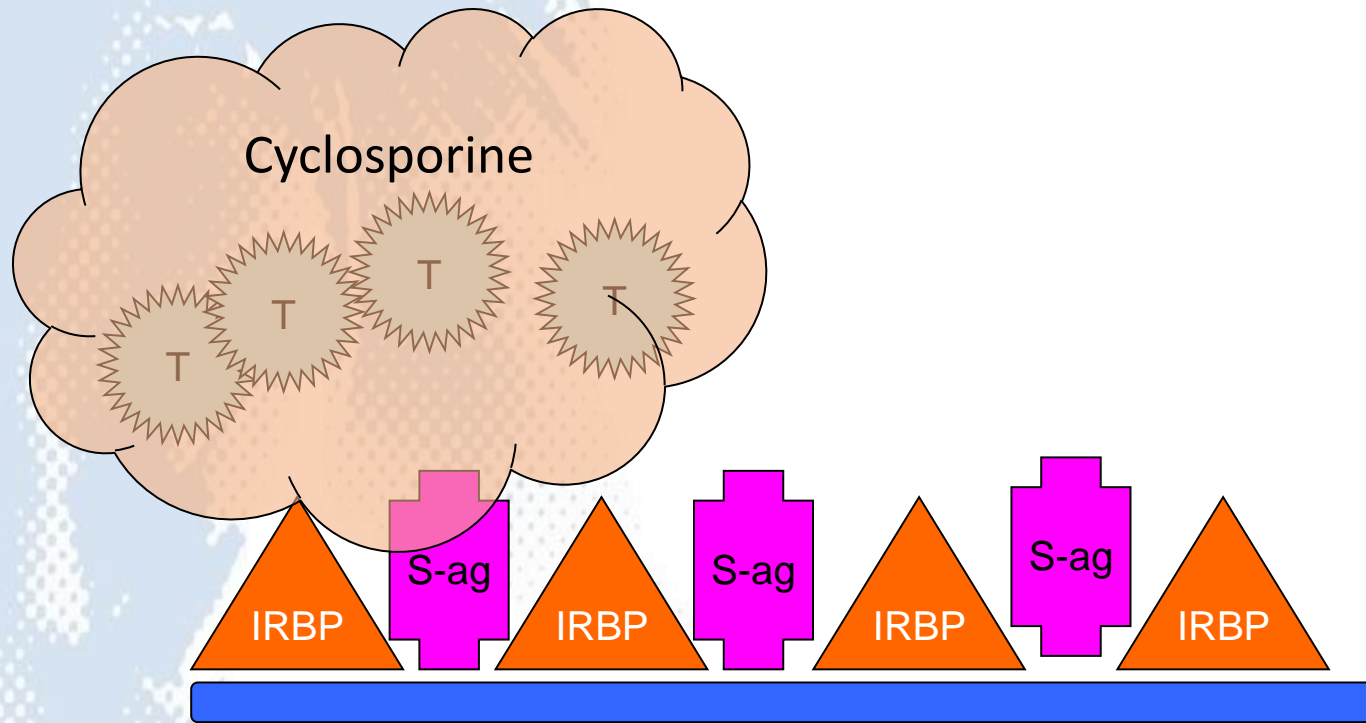
# Treatment ERU



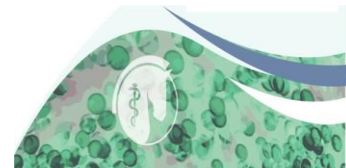
Deeg CA, et al. Inter- and Intramolecular Epitope Spreading in Equine Recurrent Uveitis. *IOVS* 2006;47:652-656.)



# Treatment ERU




Deeg CA, et al. Inter- and Intramolecular Epitope Spreading in Equine Recurrent Uveitis. *IOVS* 2006;47:652-656.)



[www.EquineOphtho.org.uk](http://www.EquineOphtho.org.uk)

Edinburgh, Scotland, EU - 2023

 **2023 IEOC Equine Ophthalmology  
Symposium  
Edinburgh, Scotland  
June 1-3, 2023**



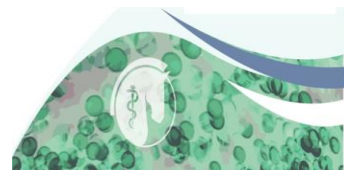
Uveitis is not always  
recurrent

Uveitis is not always  
obvious

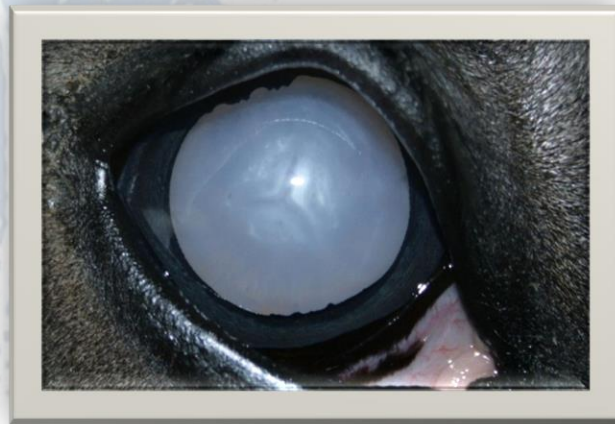
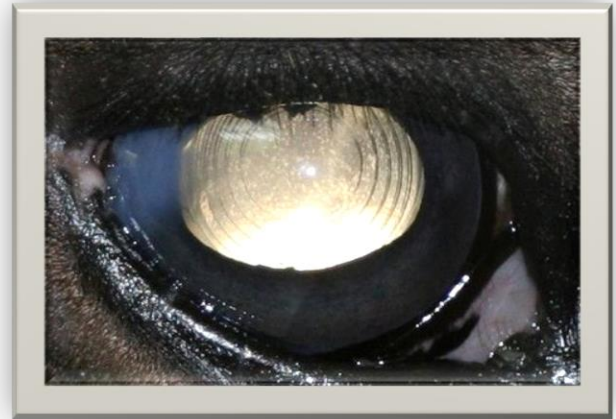
Look for a cause

ERU is a dx of  
exclusion – don't be  
afraid to challenge it

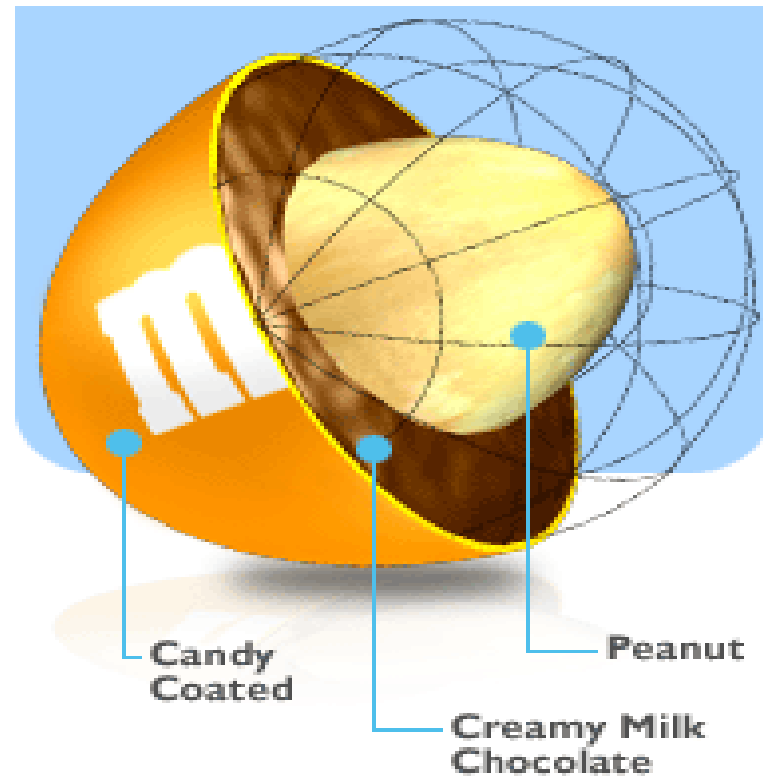
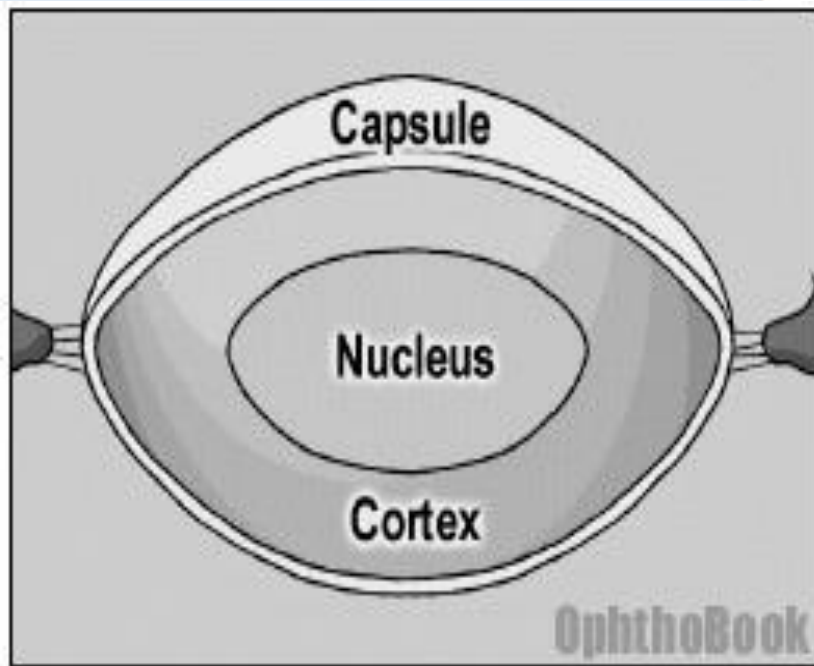
Avoid long term  
topical steroids

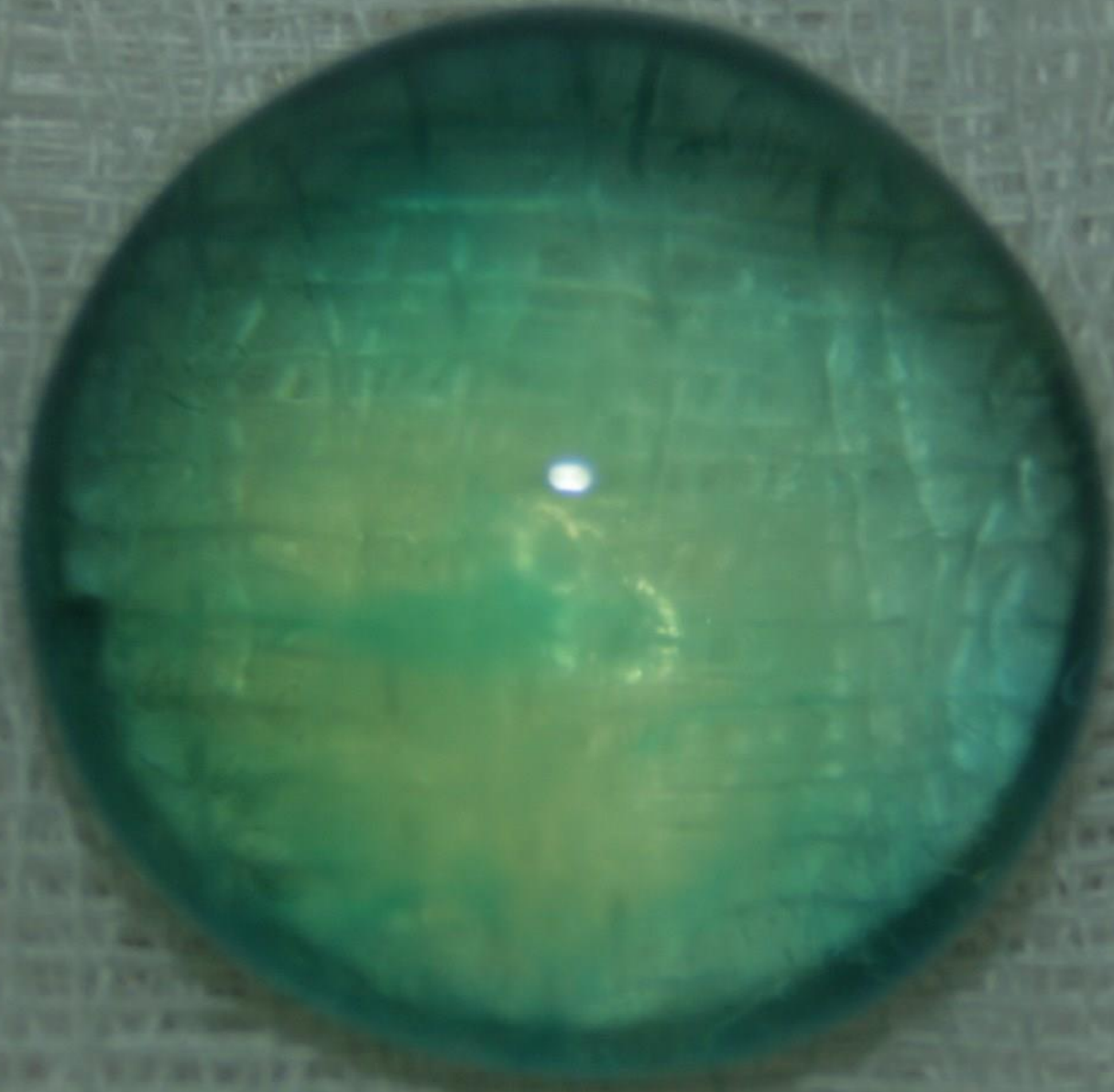


# CATARACTS

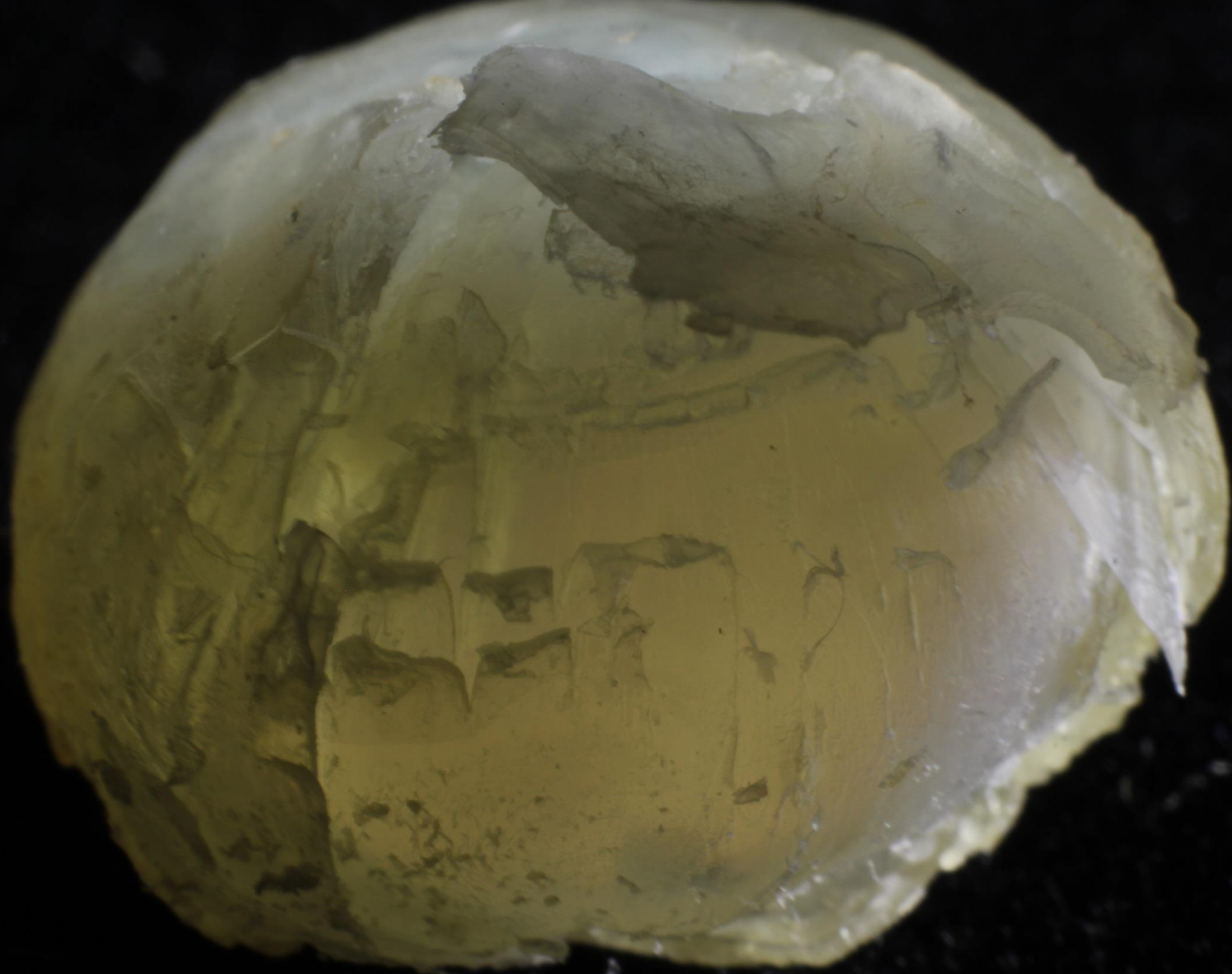


# The lens



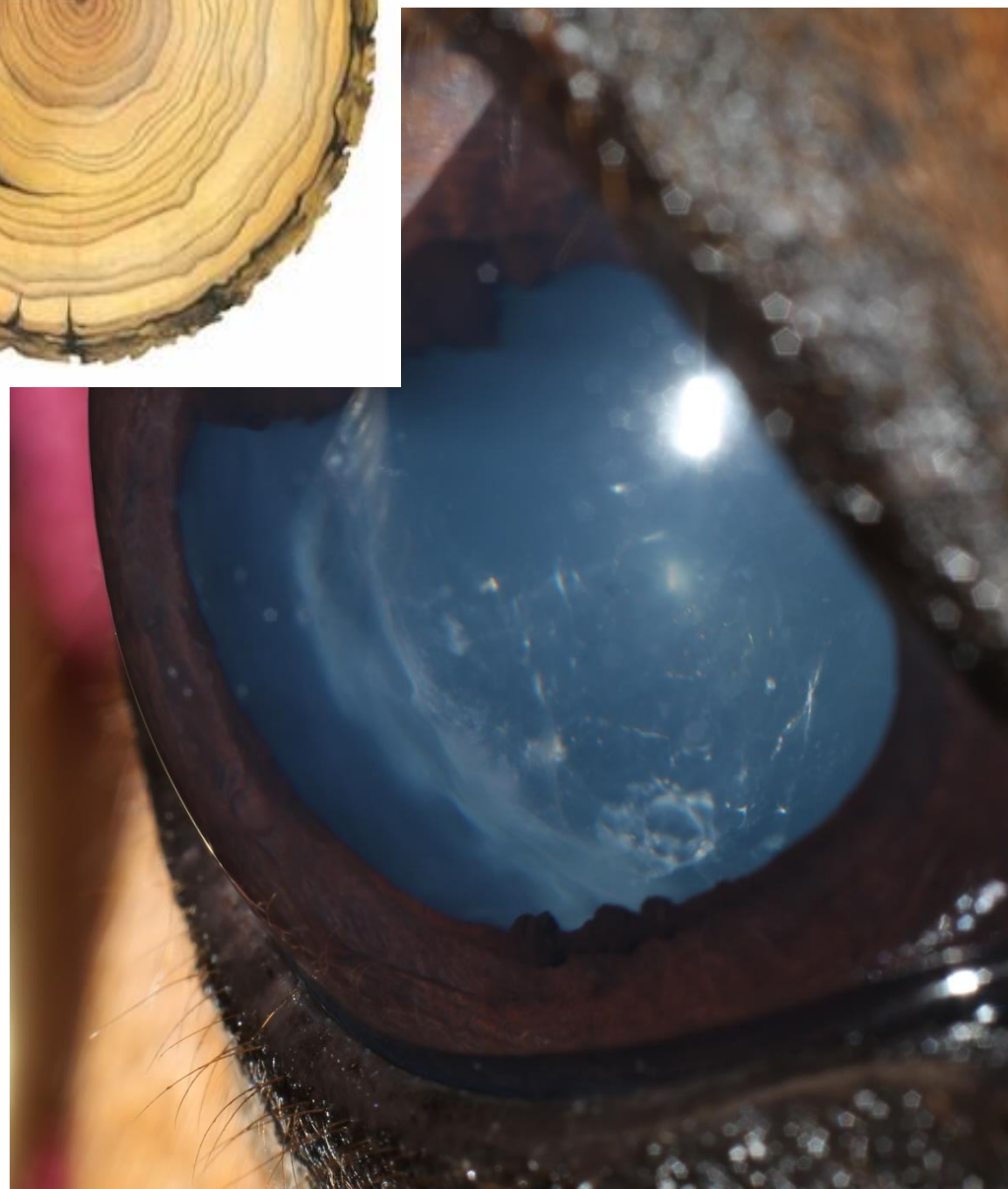
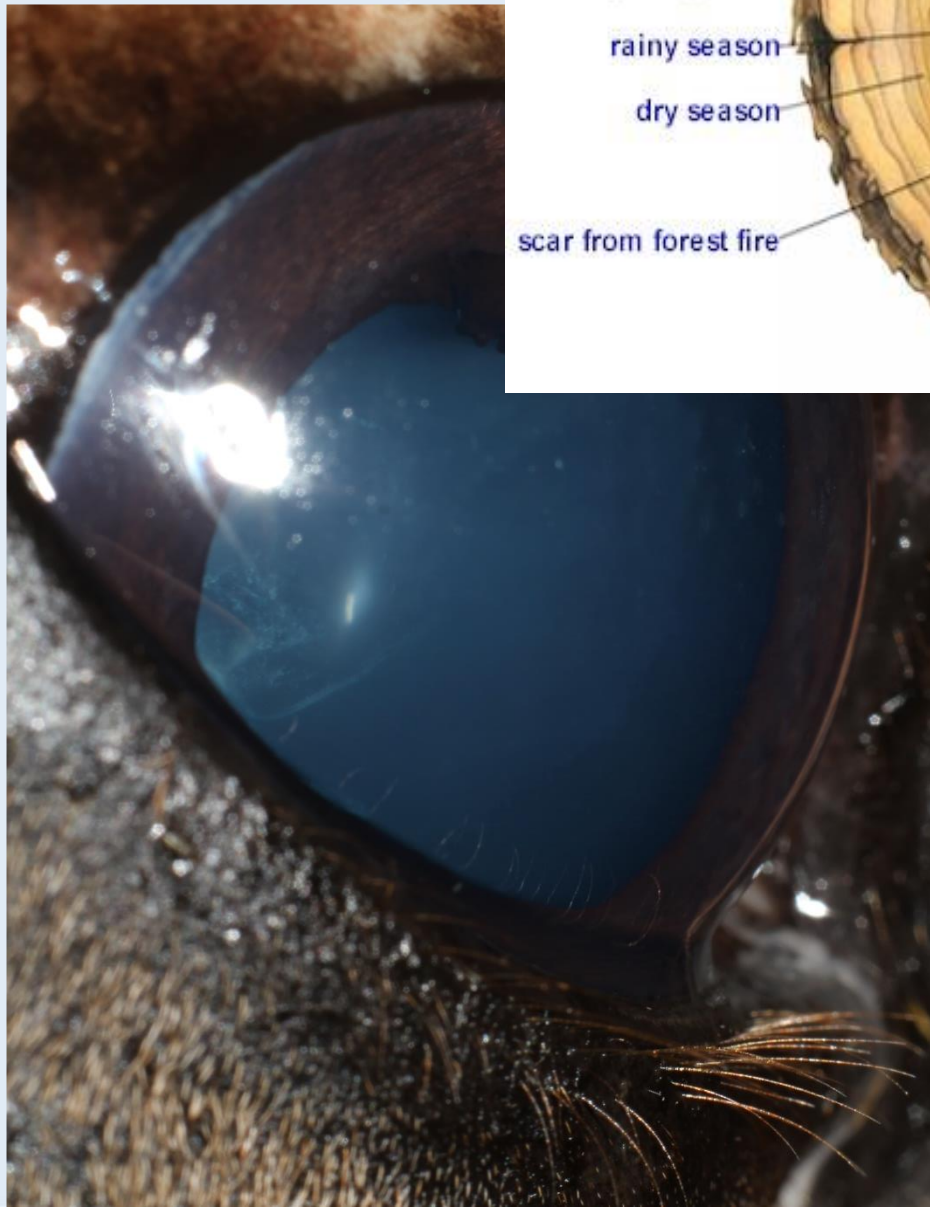
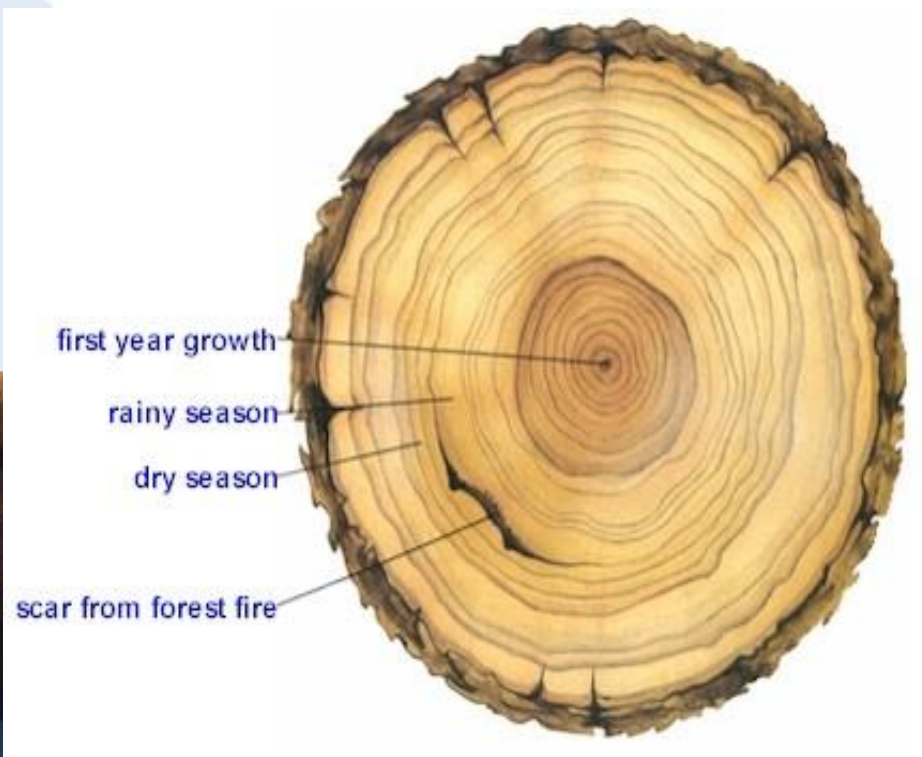






# Slit lamp

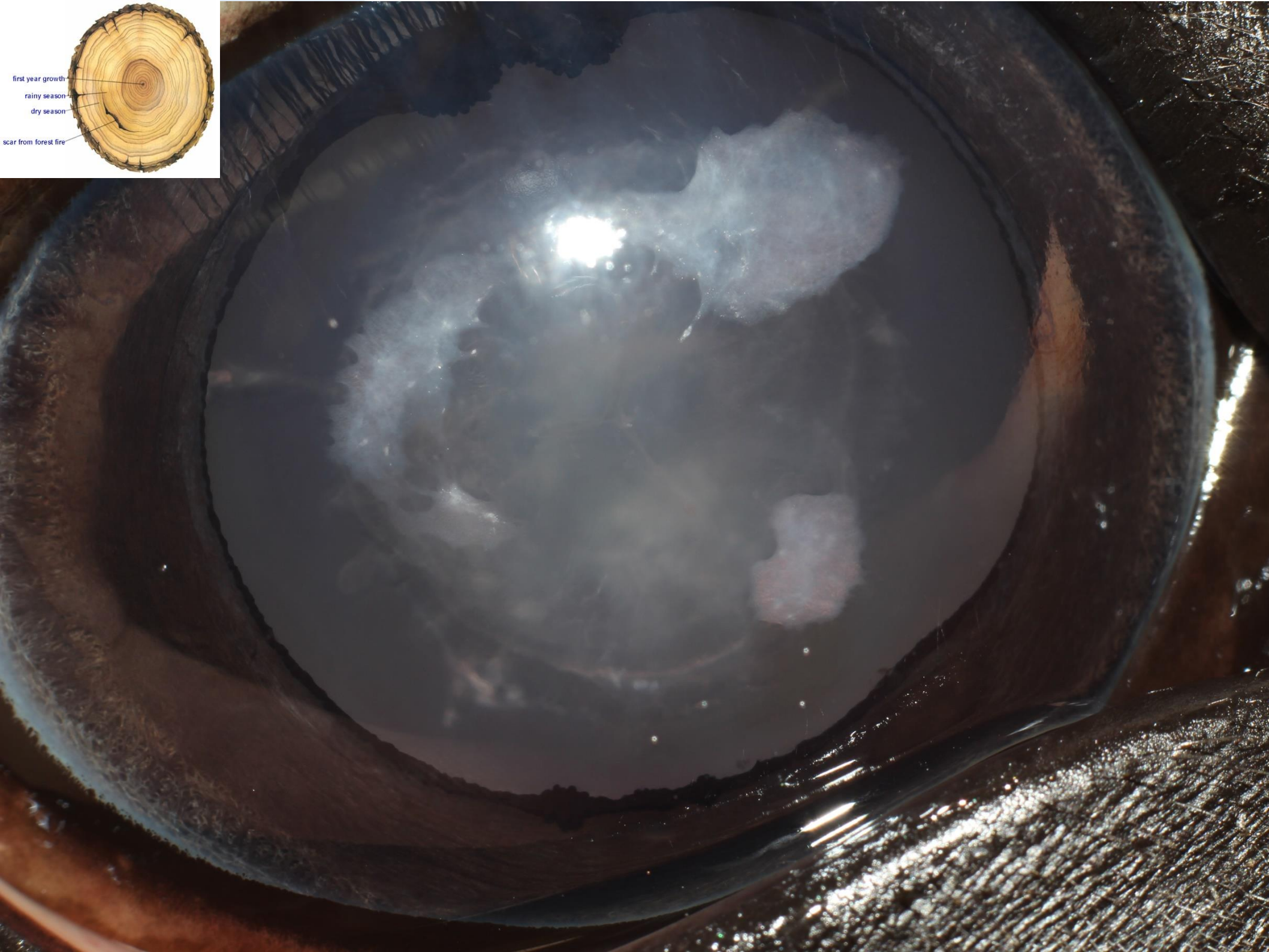


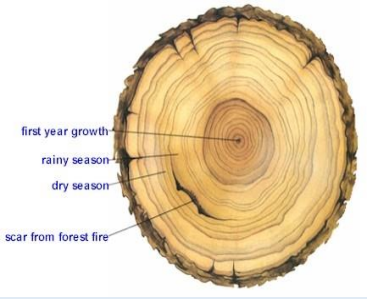


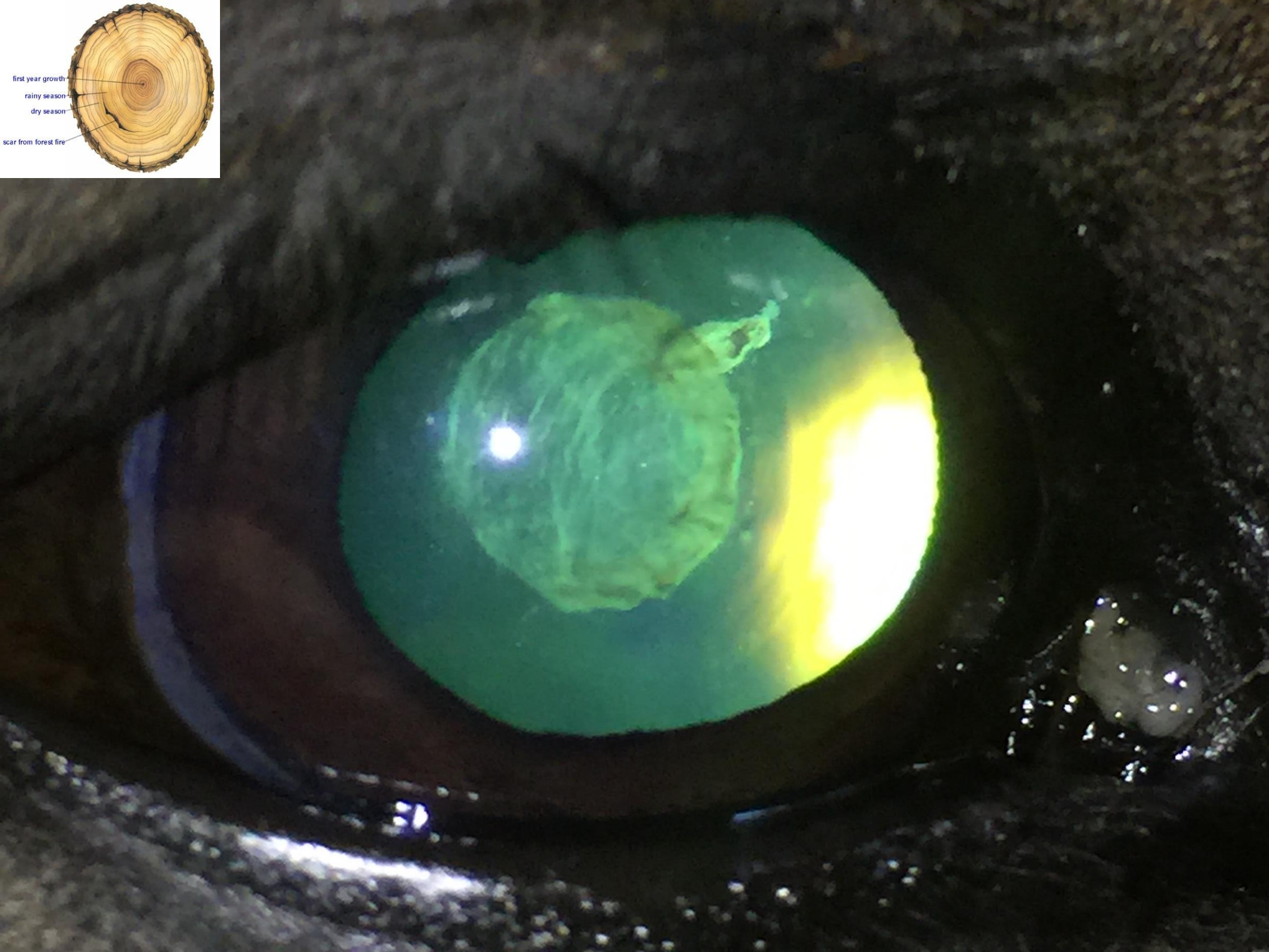


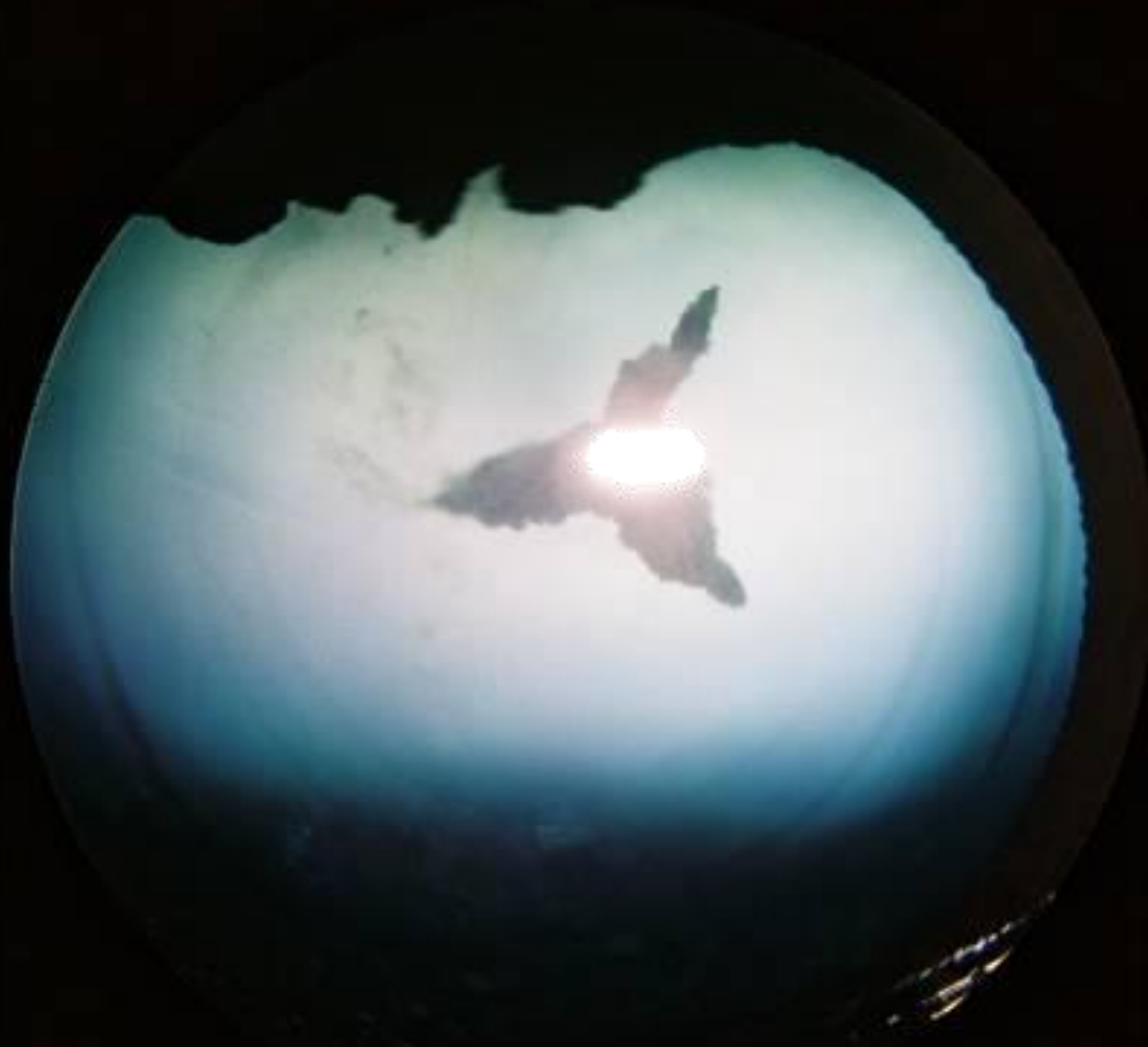












Brian Patterson

# Surgery










# International Equine Ophthalmology Consortium

- Home
- Locate a Member
- Membership
- Resources
- Education

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