UCCE BEEF CATTLE HEALTH SERIES

PINKEYE IN CATTLE

'IBK'- infectious bovine keratoconjunctivitis

JOHN ANGELOS
UC DAVIS SCHOOL OF VETERINARY MEDICINE

UC CE University of California Cooperative Extension

UCDAVIS VETERINARY MEDICINE

Today's topics:

- Cattle eye anatomy
- Pinkeye disease progression
- Risk factors for pinkeye
- Treatment and prevention programs

Learning Objectives

Recognize

foxtail vs pinkeye based on location of corneal edema

when the eyeball is close to perforating

when antibiotic treatment <u>is not</u> necessary

Understand basic cow **eye anatomy** & **what happens during pinkeye**

Know different options for treatment and prevention of pinkeye

Zoom poll Question #1

In my herd, pinkeye is:

A) an extreme challenge (lots of cases)

B) a moderate challenge (a few cases a year)

C) not at all important (rarely have cases)

D) not sure (not my job)

E) just here to learn!

Zoom poll Question #2

In my herd I mostly see pinkeye in:

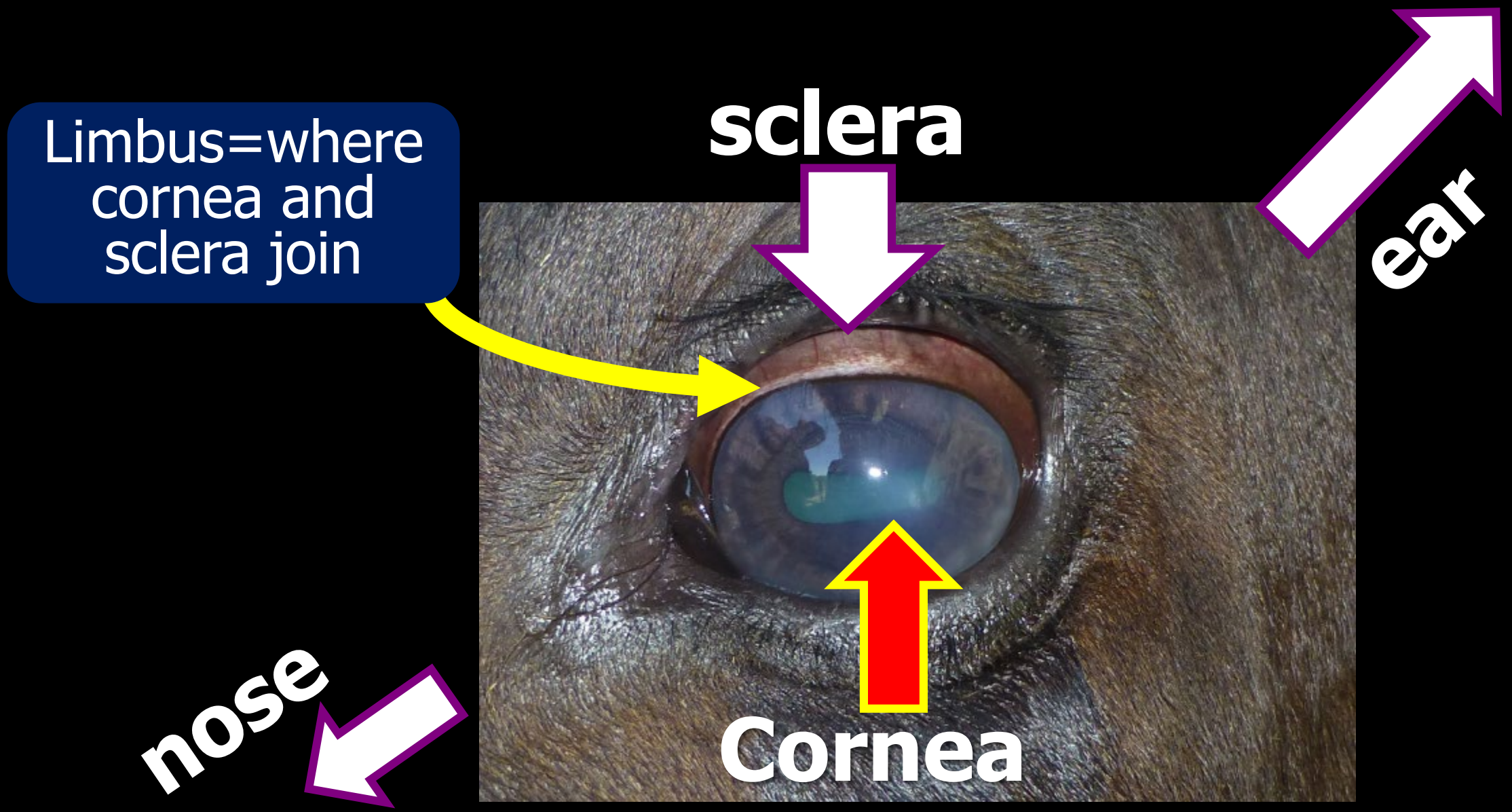
A) calves

B) weaned calves/yearlings

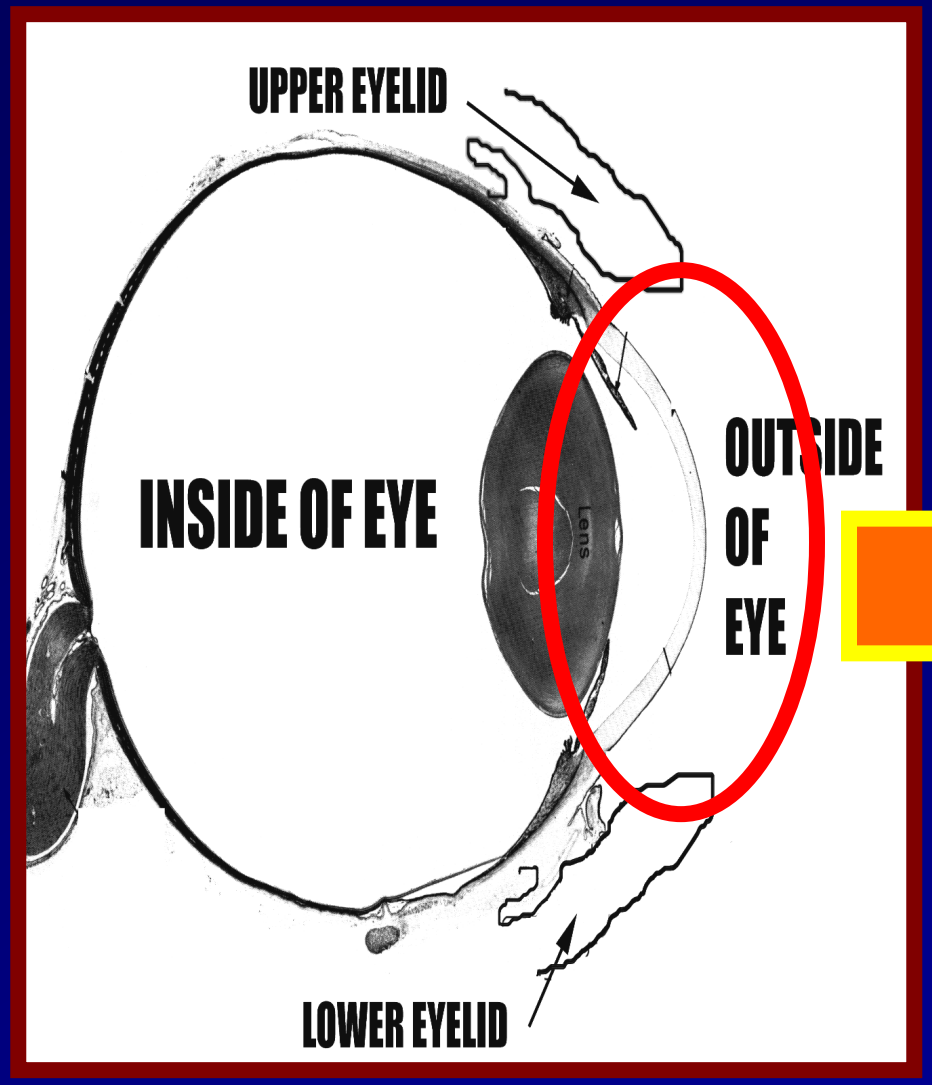
C) adult cows/bulls

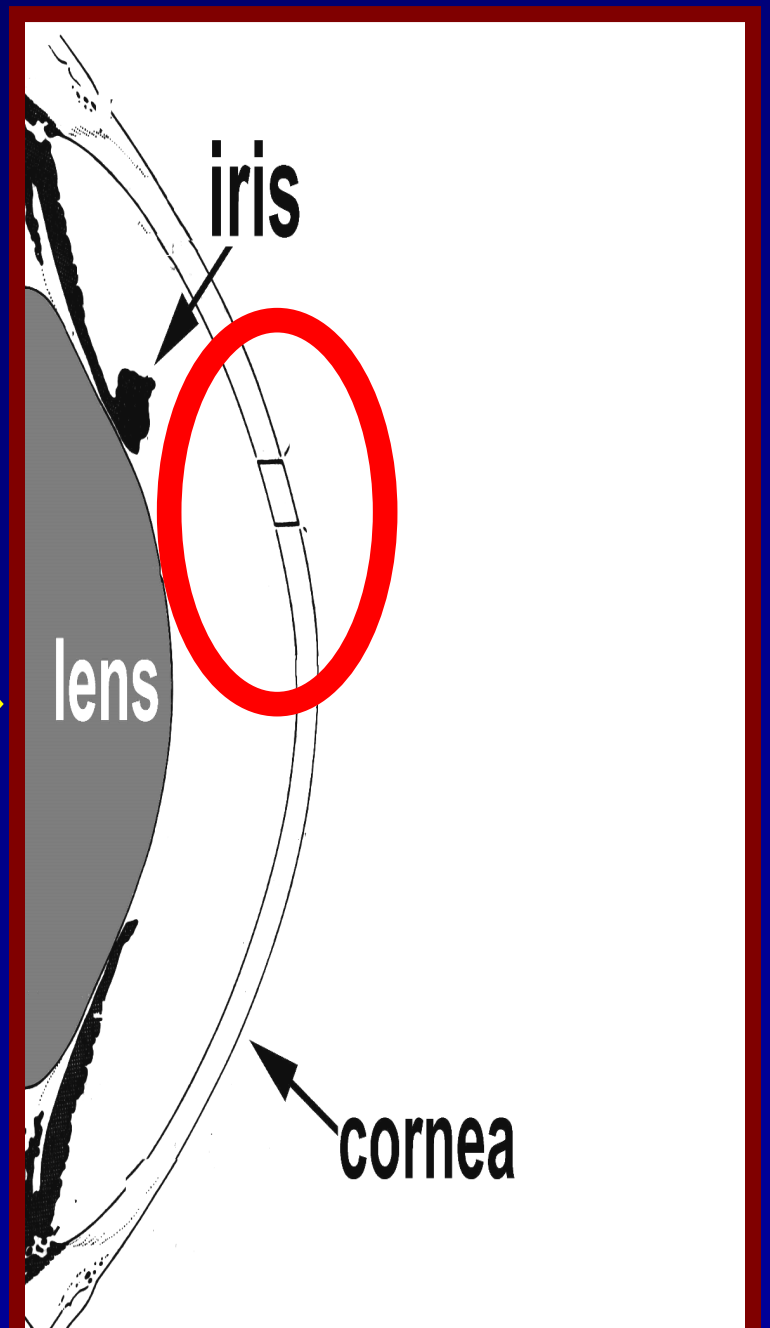
D) not applicable – just here to learn!

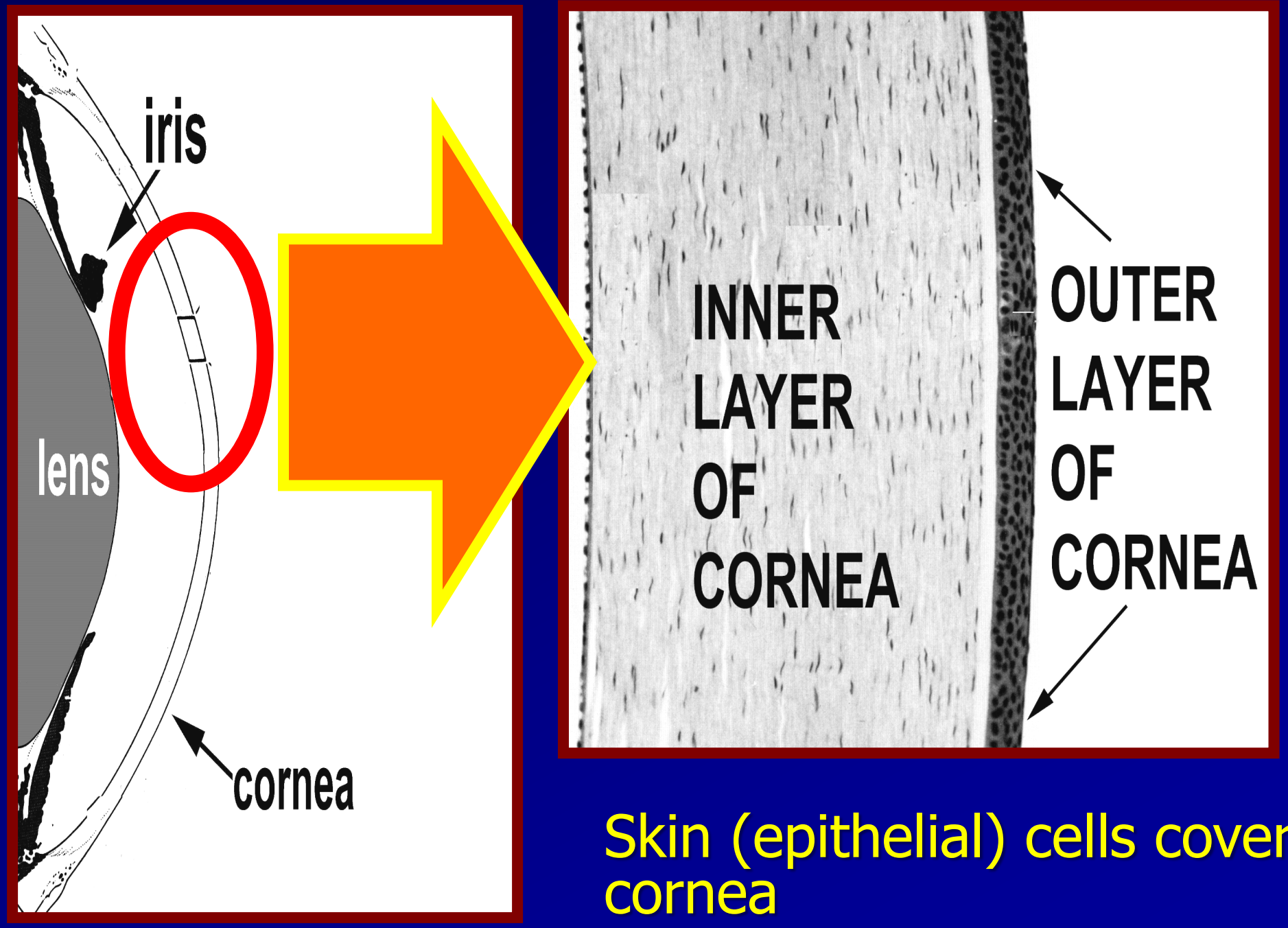
Basic anatomy Left eye



Eyeball anatomy







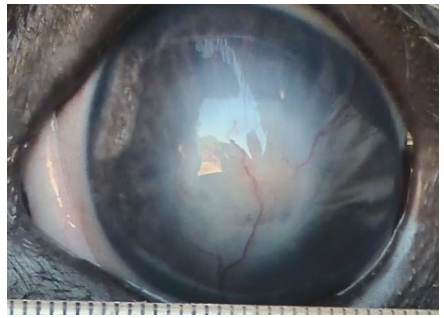
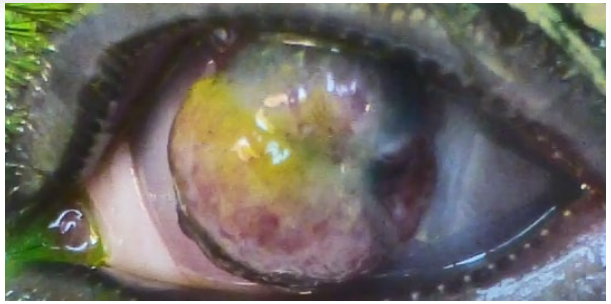
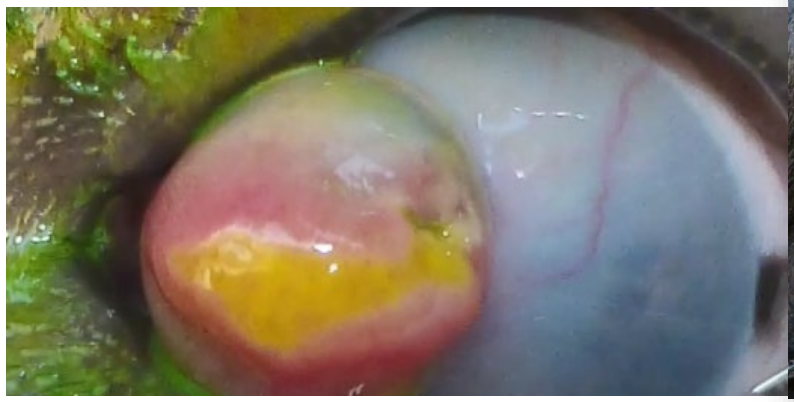
Skin (epithelial) cells cover the cornea

Signs of pinkeye in cattle

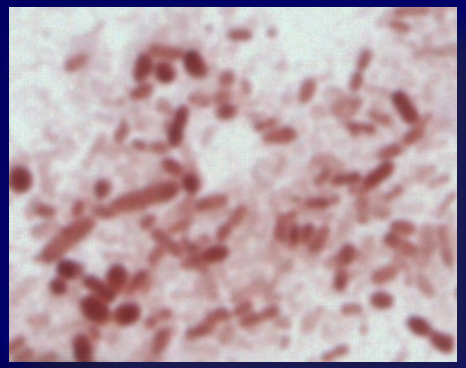
- Tearing
- Corneal edema
- Corneal ulcers
- Eye pain (squinting)
- Corneal scarring
- Complete healing
- Eyeball rupture
- ‘Popeyes’
- Partial/permanent blindness

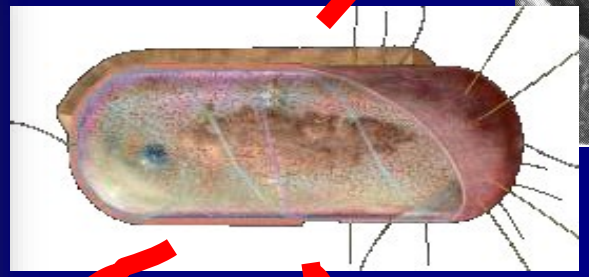


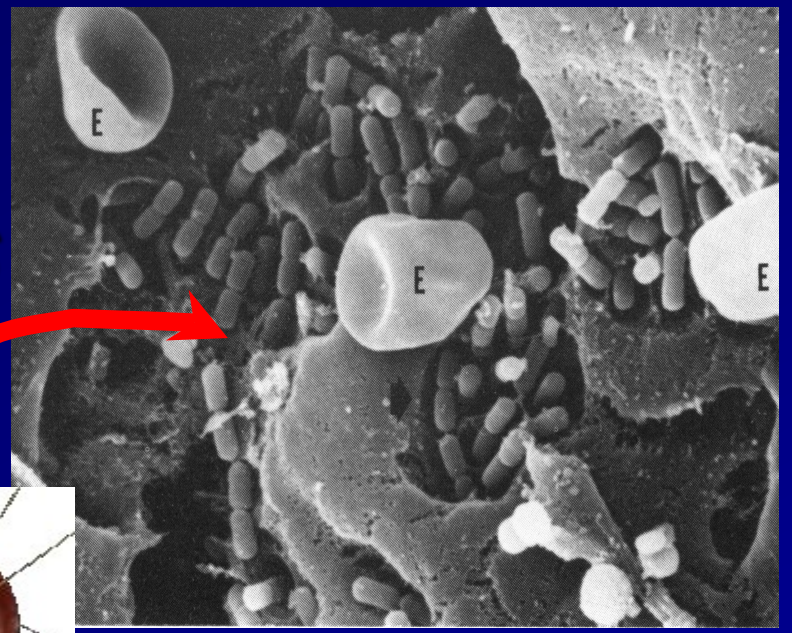


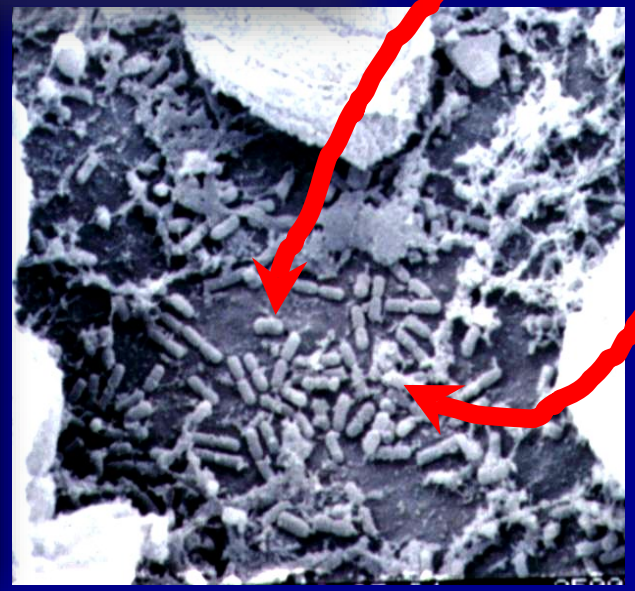




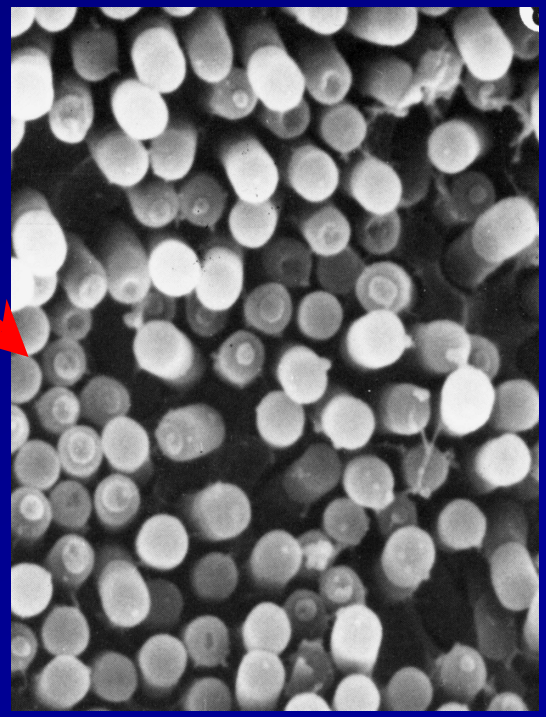

Infection of the eye with ***Moraxella bovis*** causes Pinkeye....





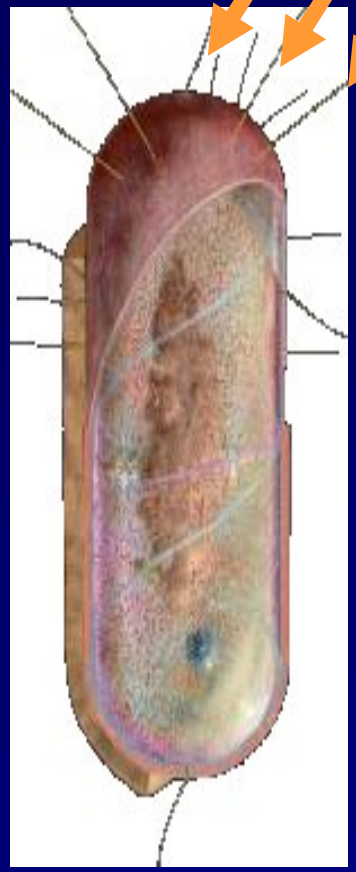


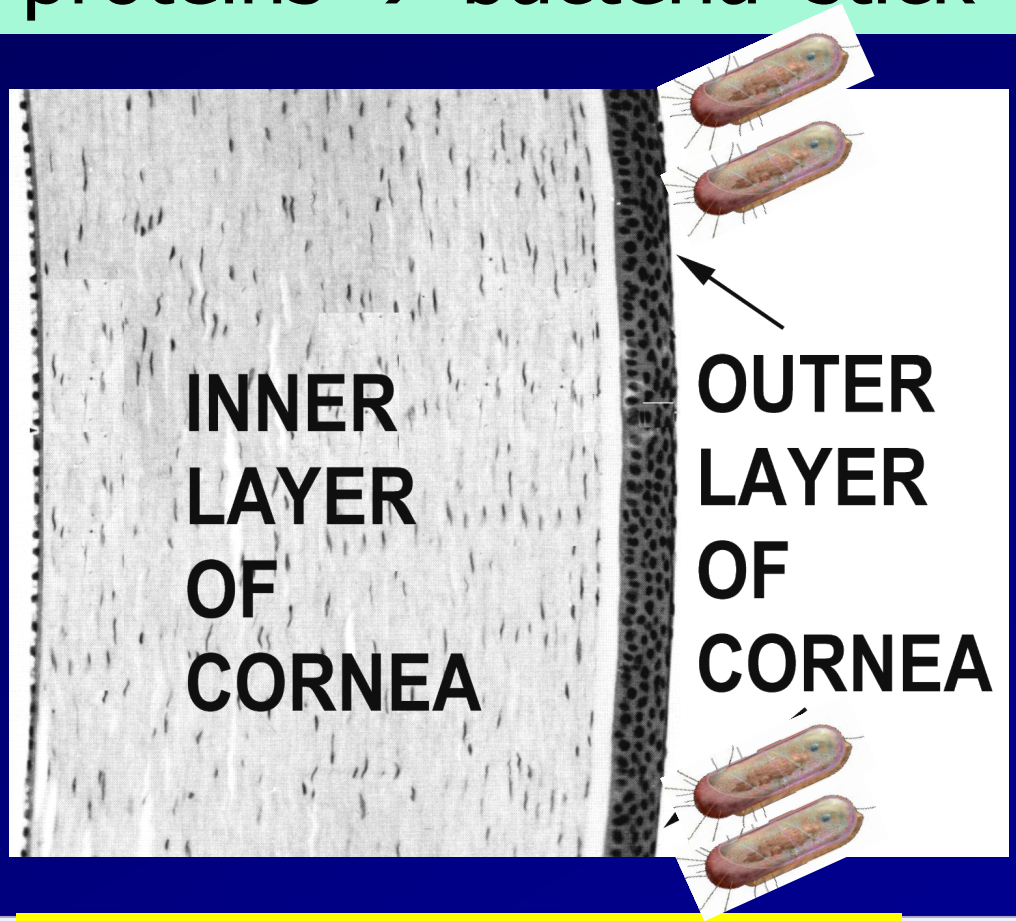


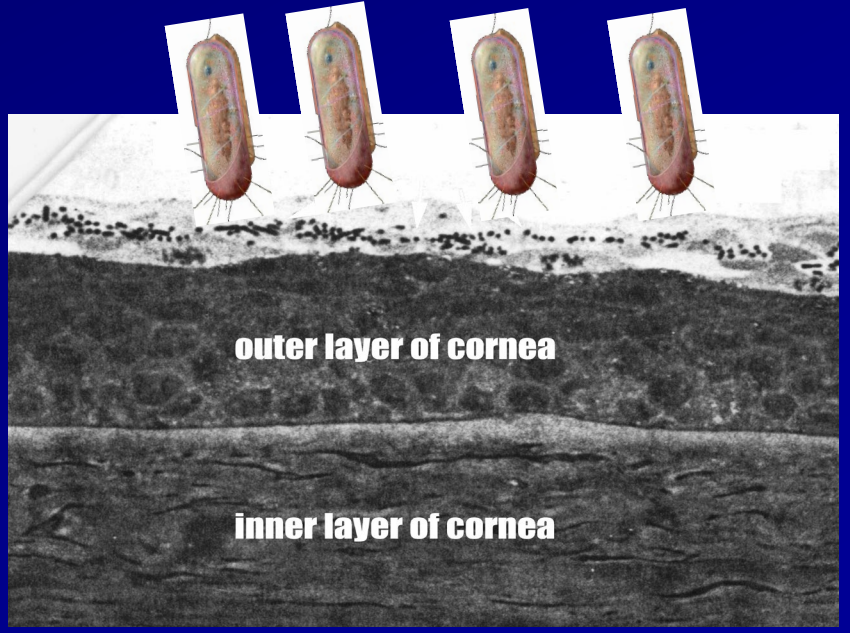


Infection starts on eye surface…

'Pilin' proteins → bacteria 'stick' to the eye surface

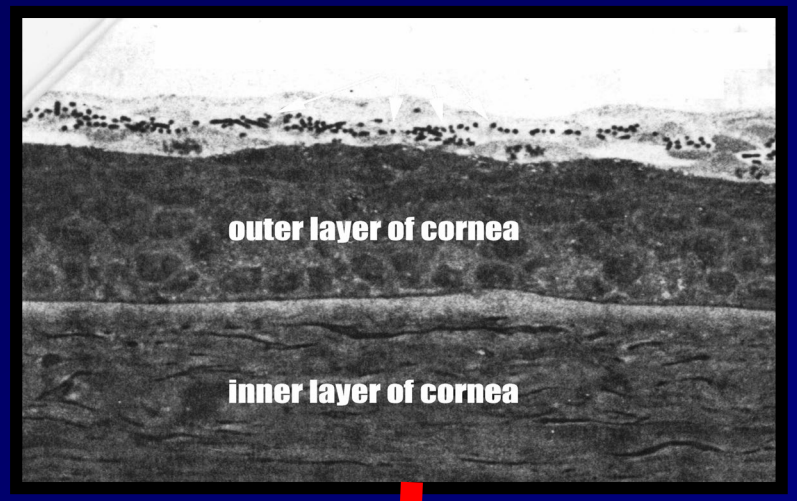




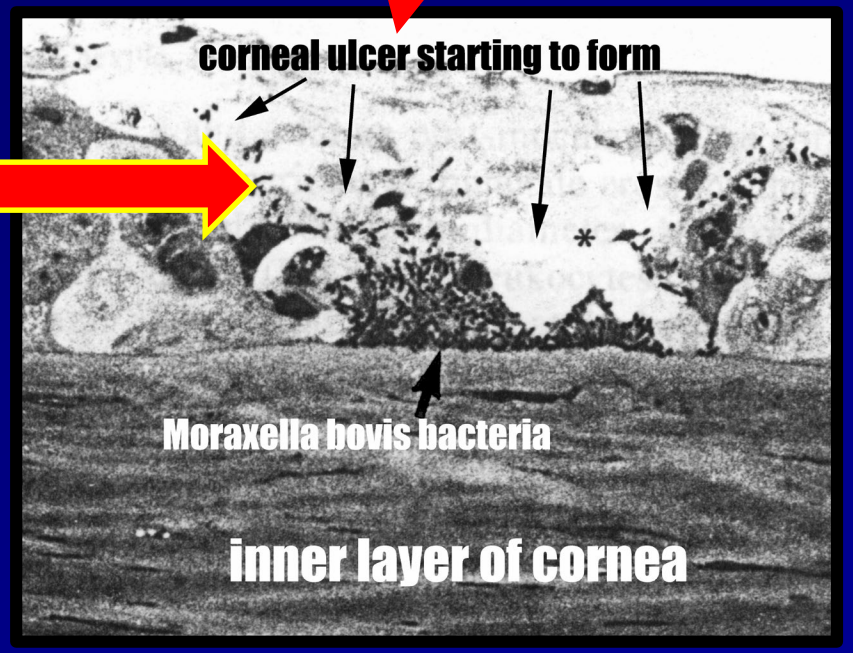


- 7 different 'serogroups' of *M. bovis* pilin
- Likely affects vaccine effectiveness

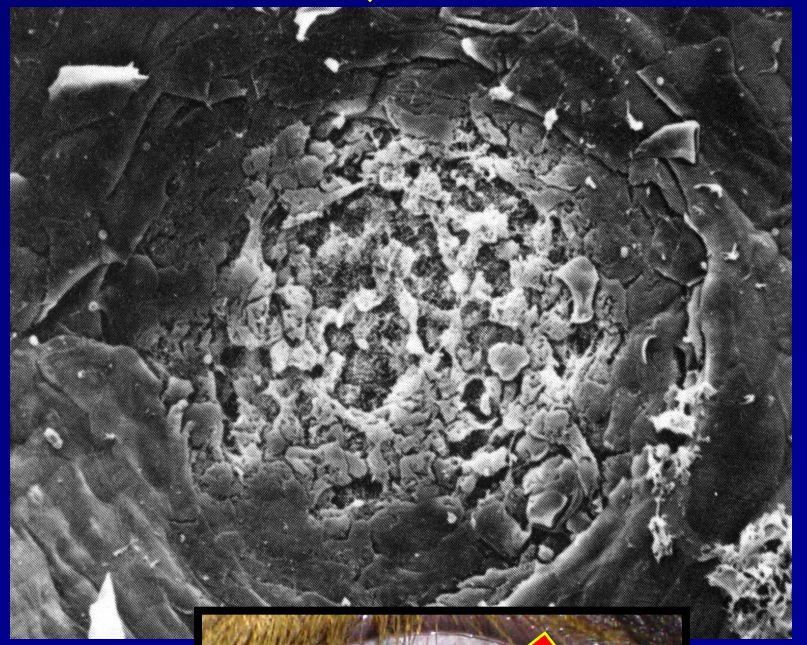
then goes deeper…

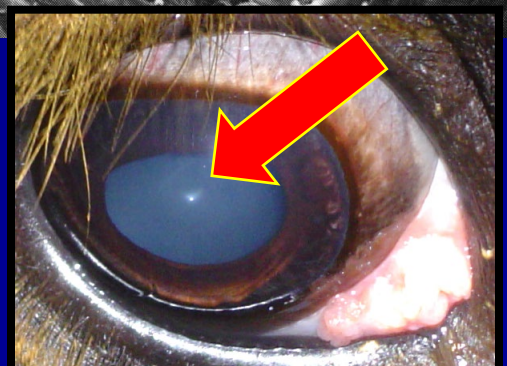


'Cytotoxin' kills corneal cells

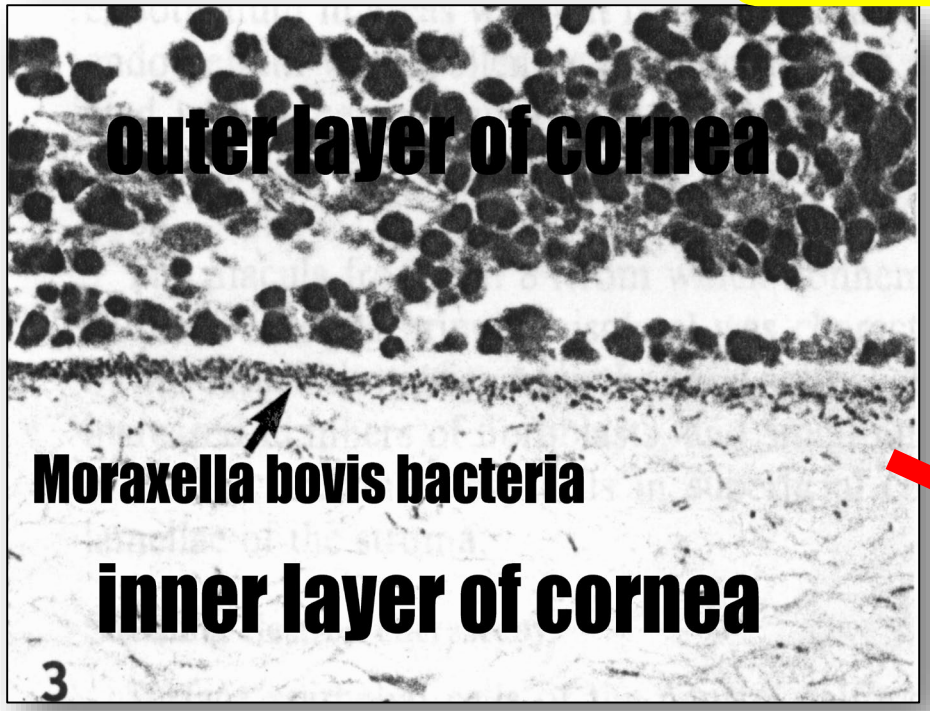


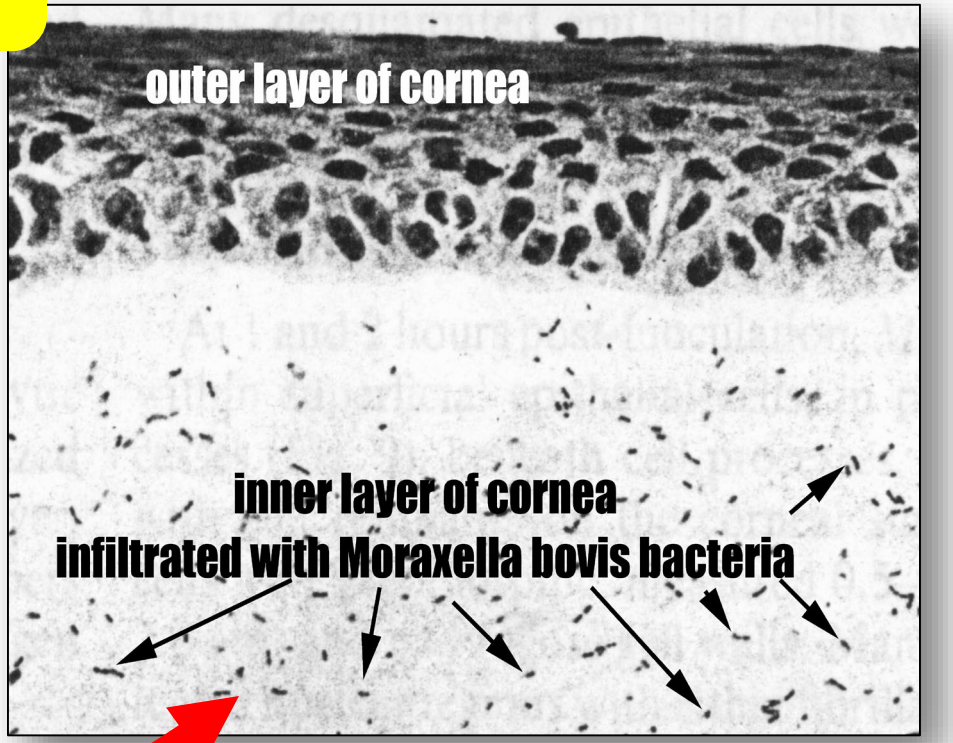
Bird's eye view of ulcer





and deeper…

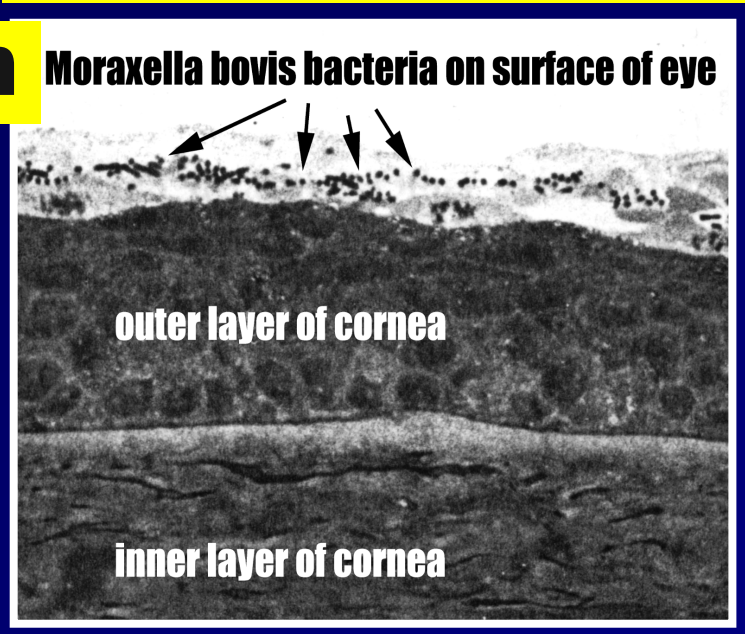




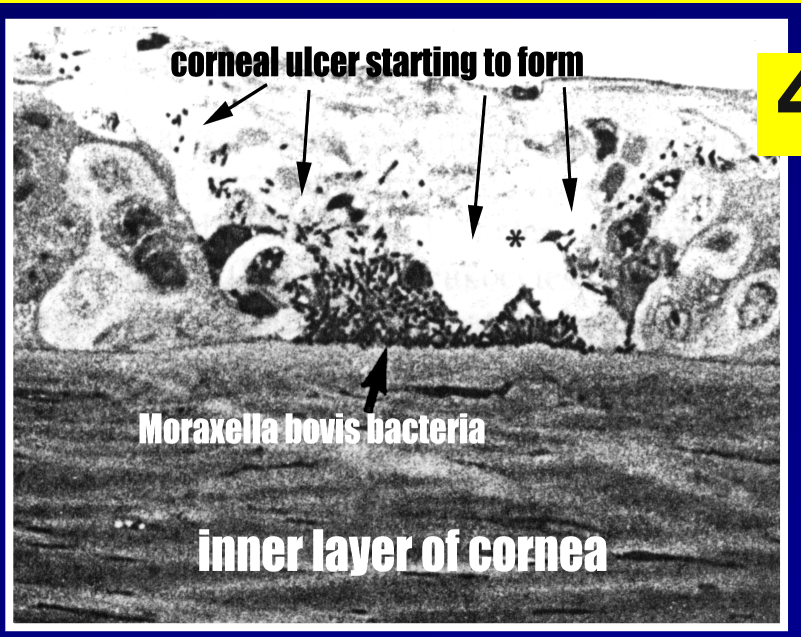
- Cytotoxin can kill white blood cells (WBC) that enter the eye to fight the infection.
- Suspected to cause increased 'host' injury when the WBC are killed.

How quickly does this happen?

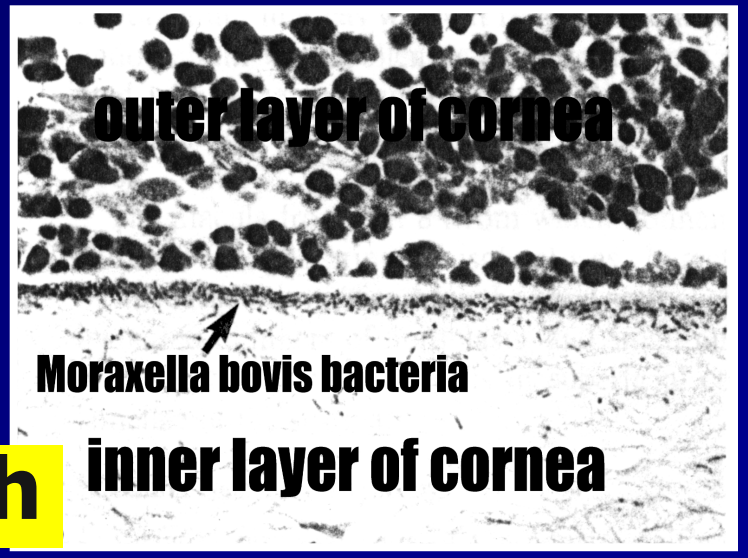
2 h

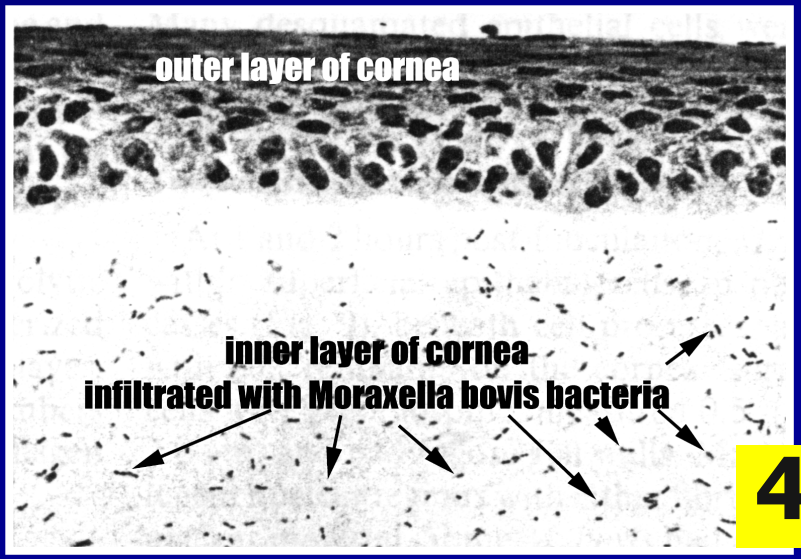


4 h



24 h

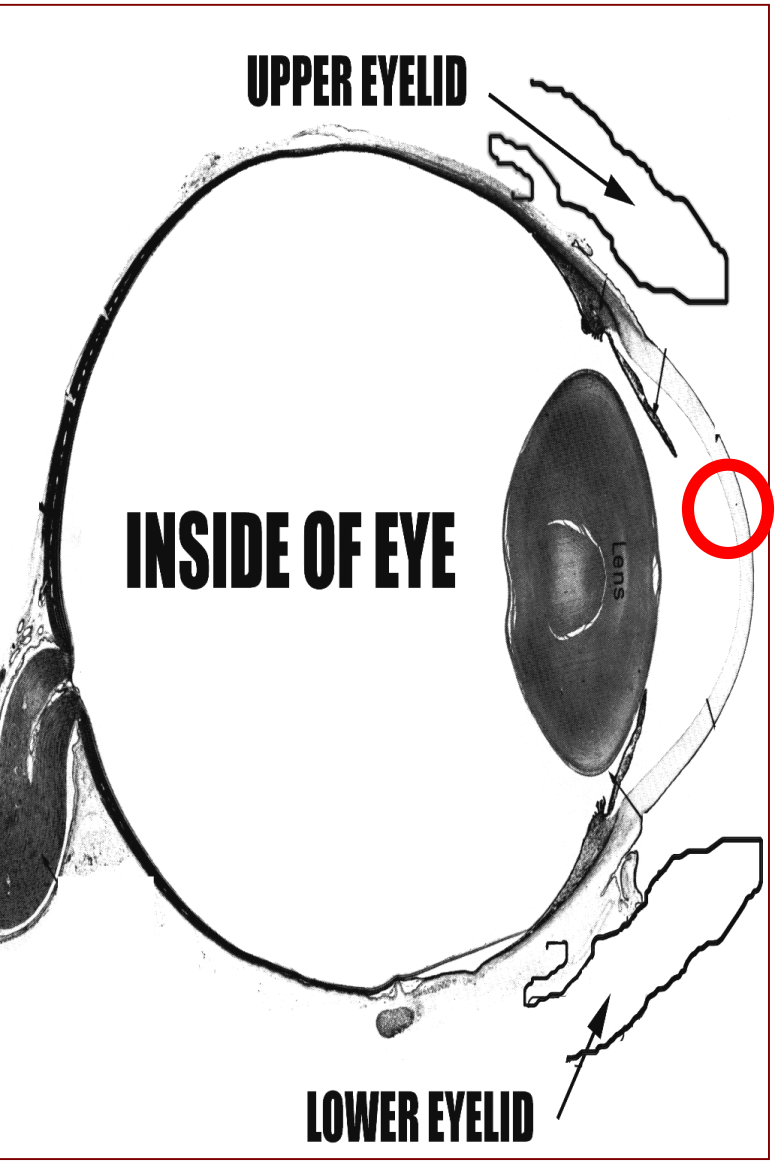


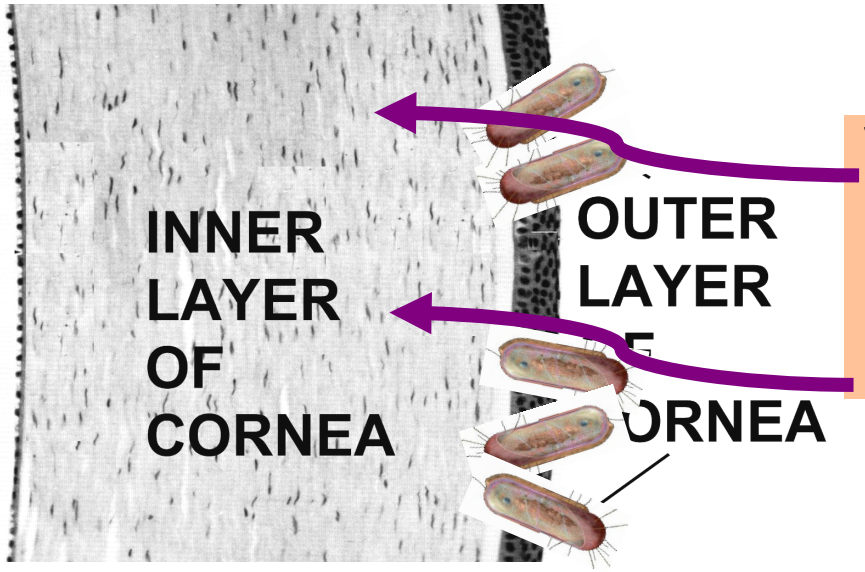


45 h

Rogers et al. *Vet Path* 1987

What causes corneal ‘edema’?

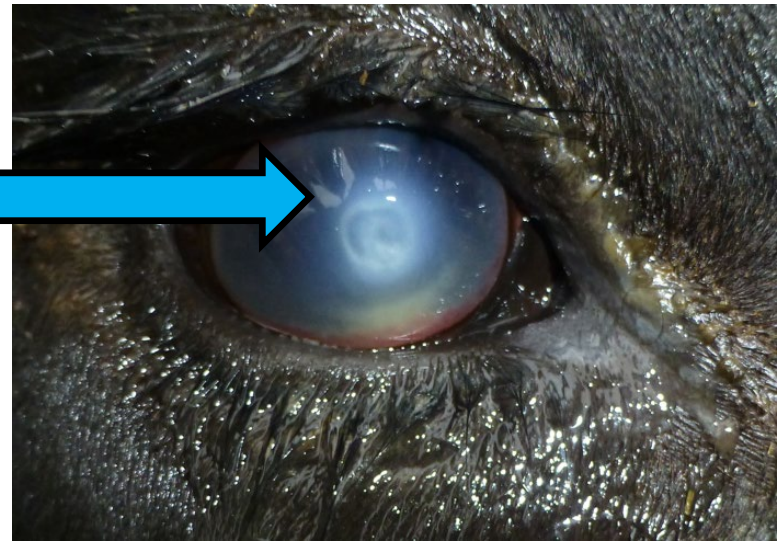




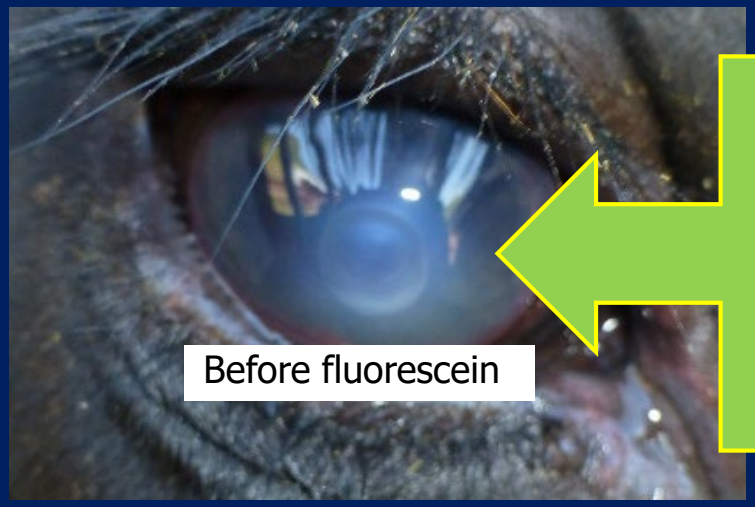
Water gets inside the inner layer of cornea

When the ‘stroma’ of the cornea is exposed to water, it turns a hazy bluish color

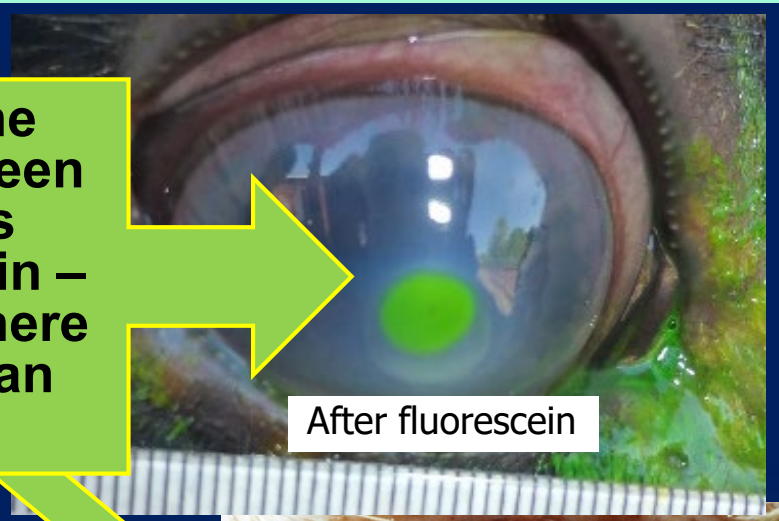
‘CORNEAL EDEMA’



Interpreting colors in the injured eye

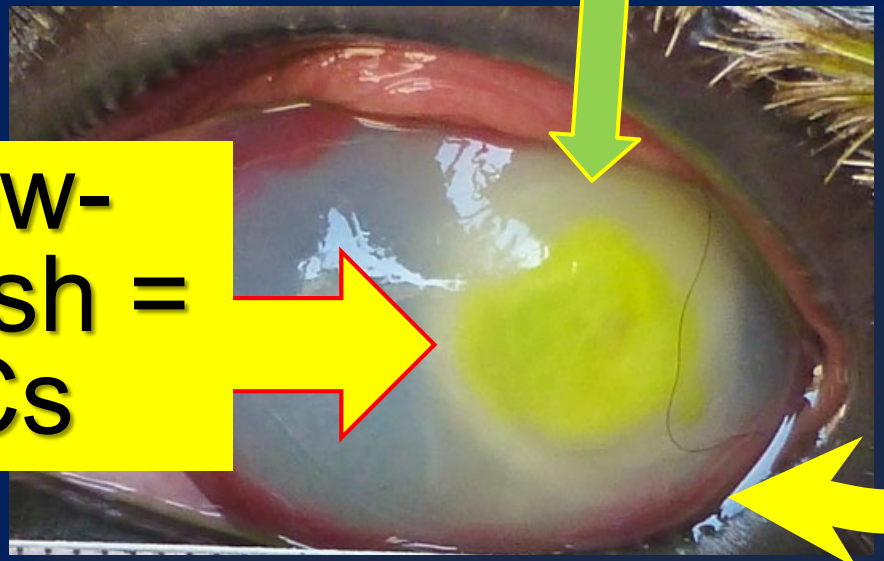


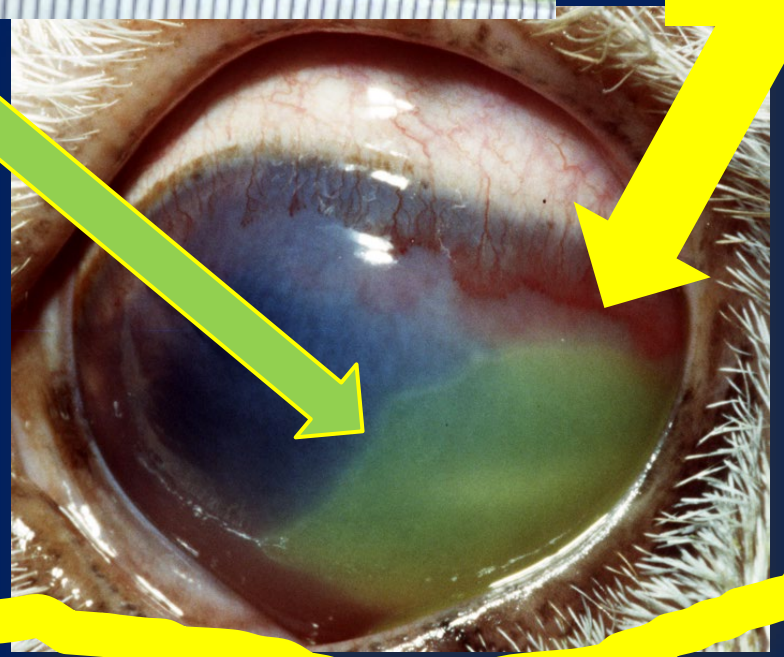
Note: the yellow-green color is fluorescein – shows where there is an ulcer

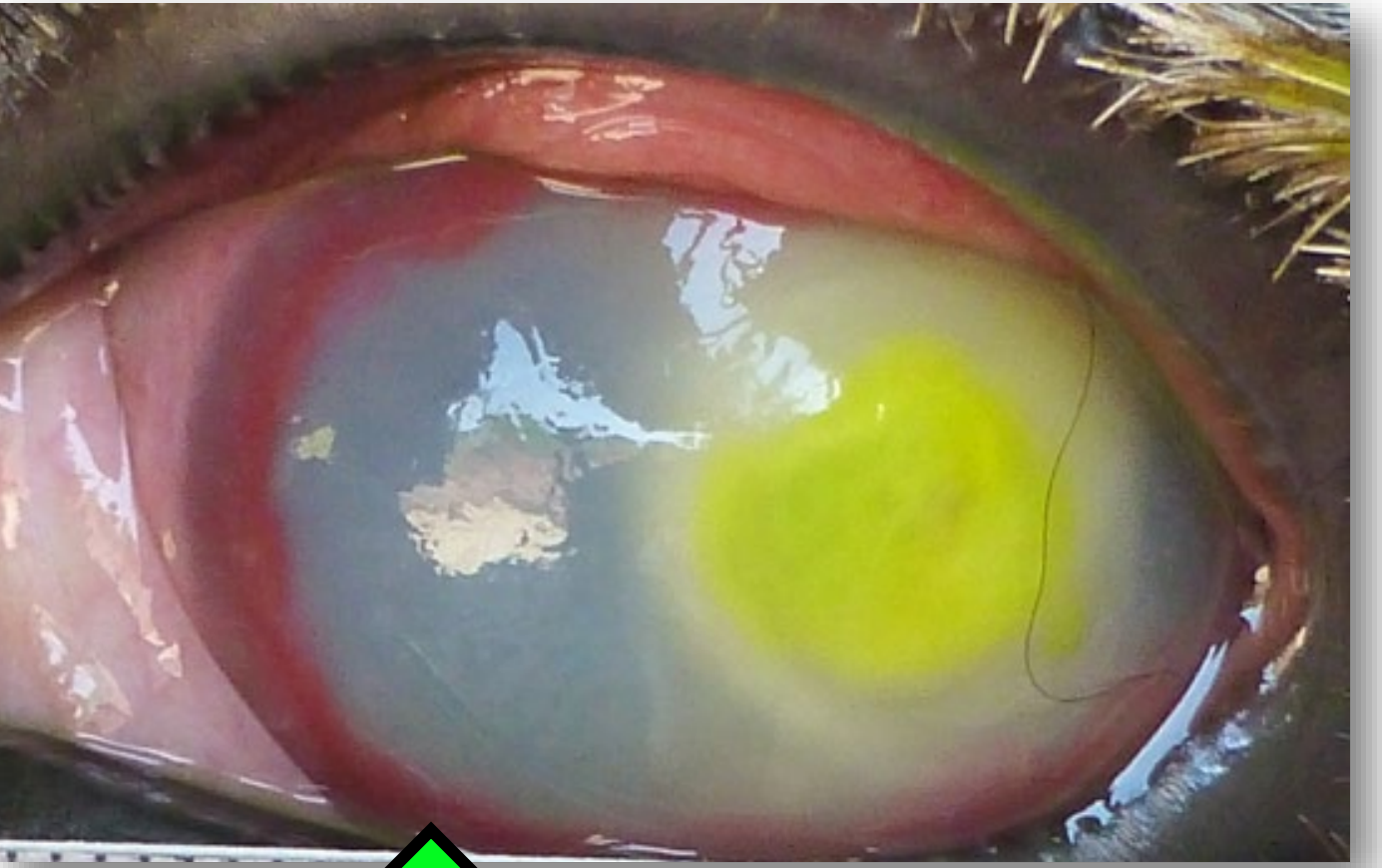


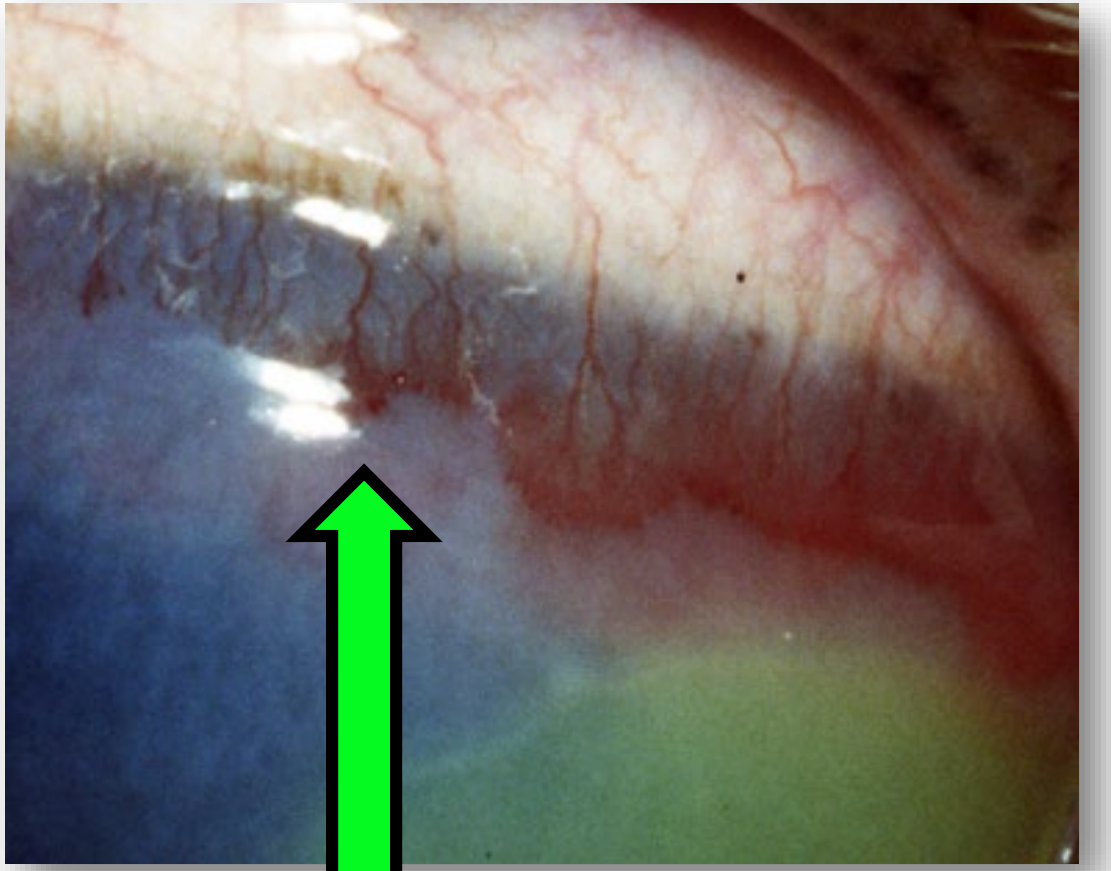
Red=new blood vessels

Yellow-whitish = WBCs



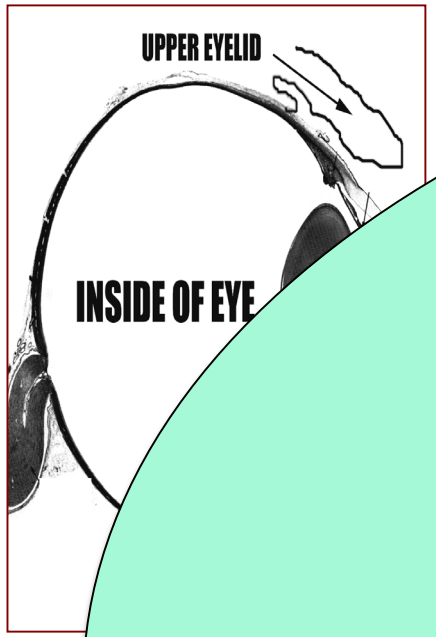






Deep vessels: “hedges” =
These take 3-5 days to appear
Then grow ~1/32nd inch/day

Superficial vessels = trees



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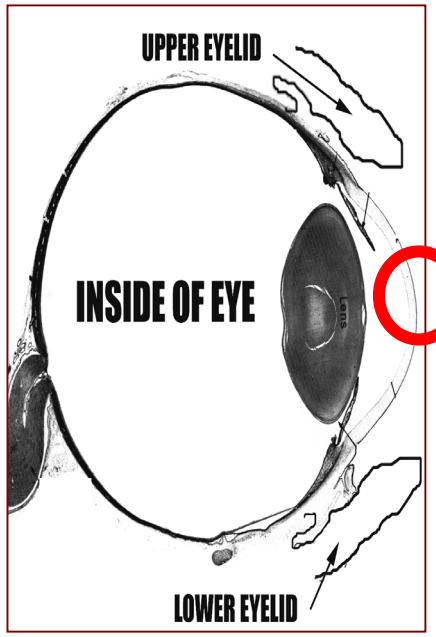
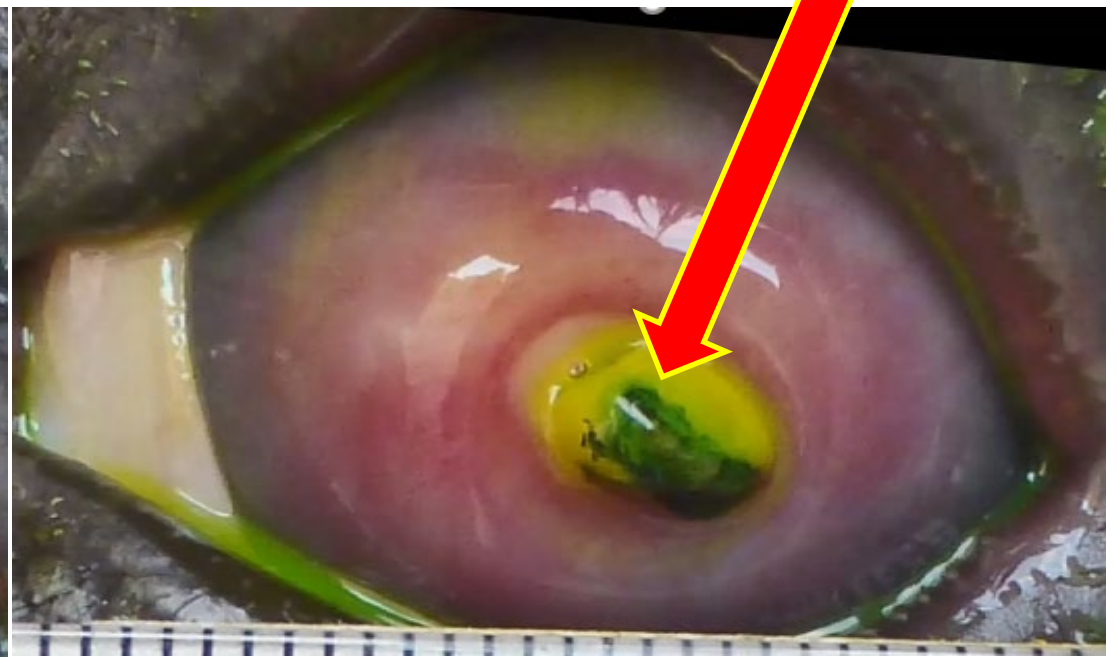
to

When is the eyeball close to perforating?

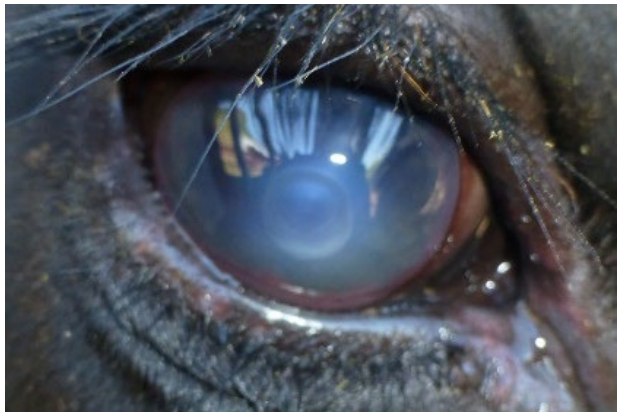


Black in the center of an ulcer is a <u>BAD</u> sign…eye is close to perforating (‘popping’)

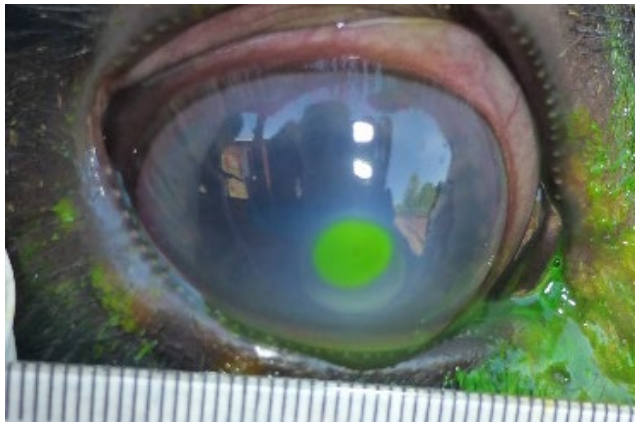
Same eye 7 days later→ see iris



‘Mild’ corneal perforation without complete eyeball rupture



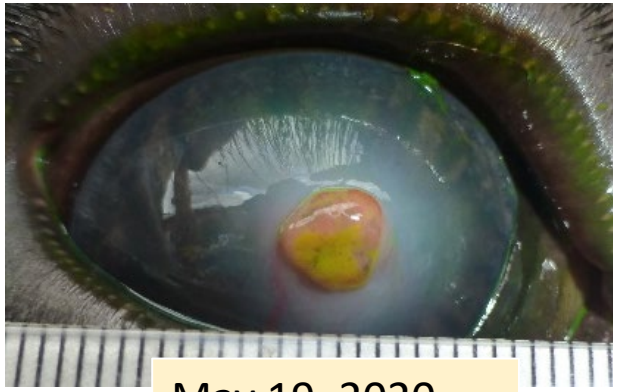
Ulcer first seen on April 28, 2020



Ulcer stained with fluorescein dye

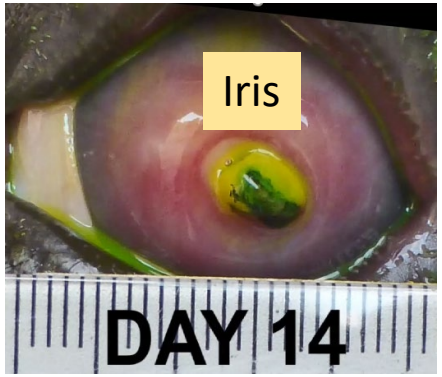
May 5, 2020: cornea perforated; iris showing.
Received banamine and oxytetracycline

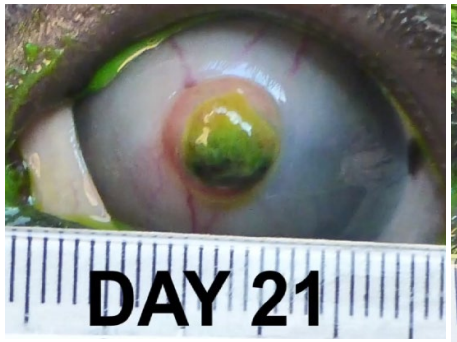
May 12, 2020

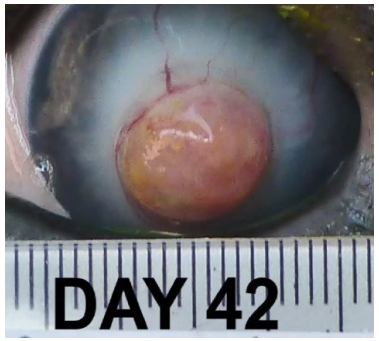


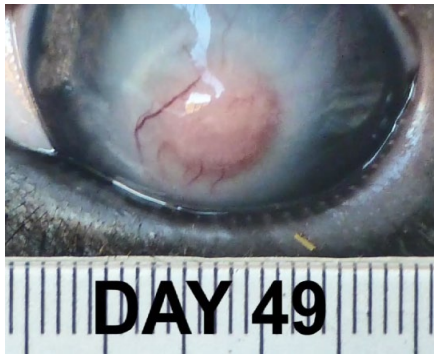
May 19, 2020

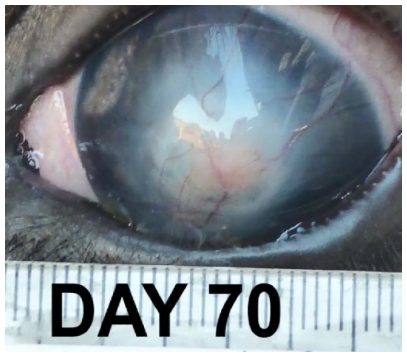
Example of complete eyeball rupture



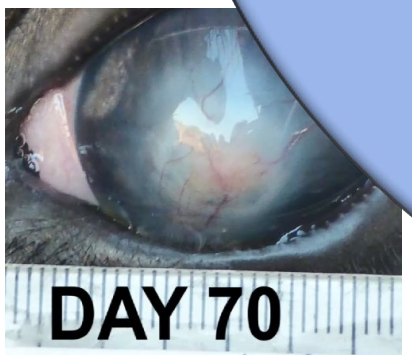


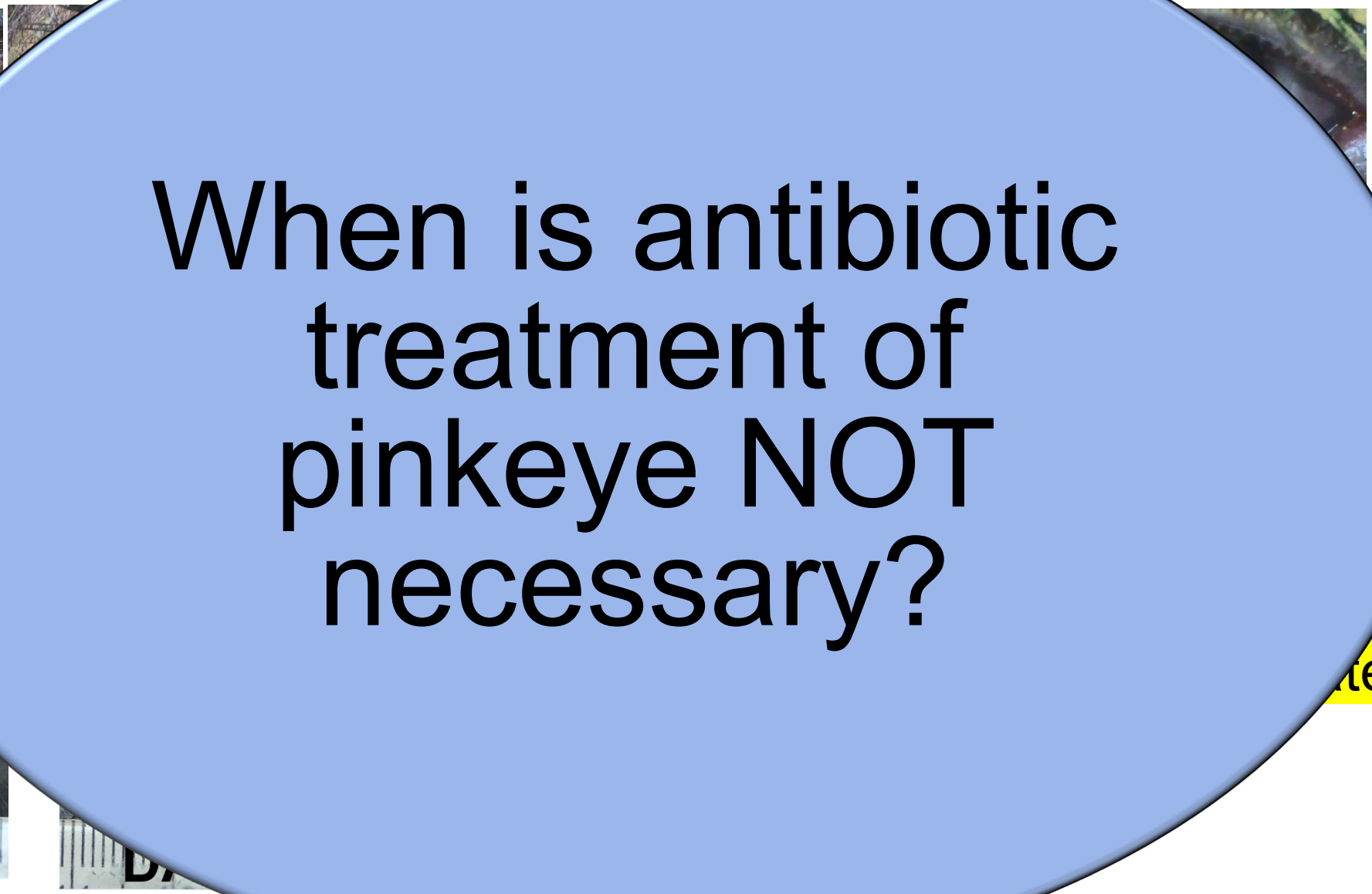






Exampl… …l rupture

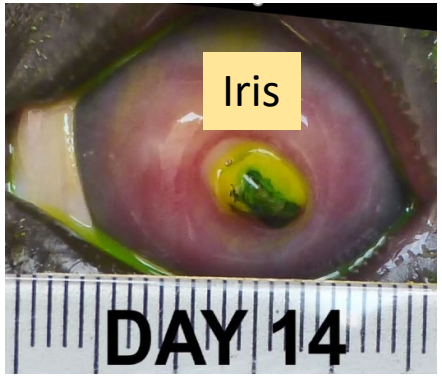


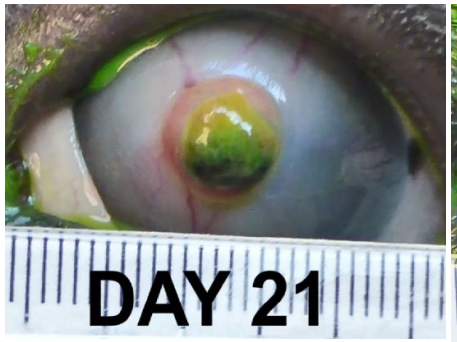


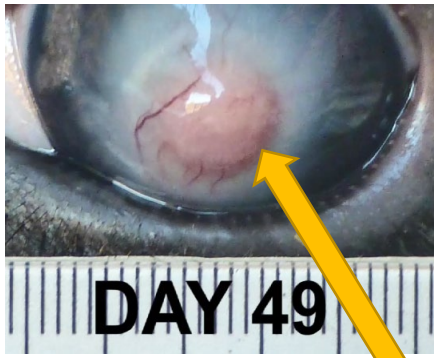
When is antibiotic treatment of pinkeye NOT necessary?

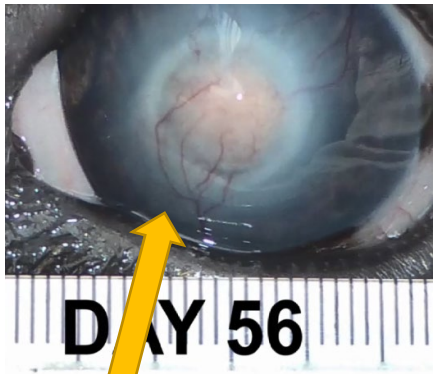
…te that

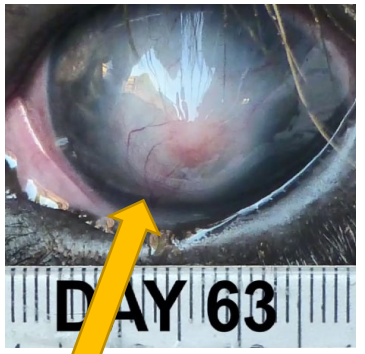
If blood vessels cover the corneal scar, the eye is already healed!!



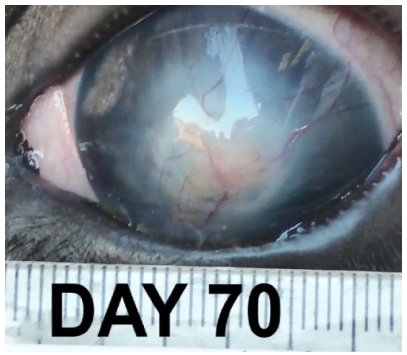


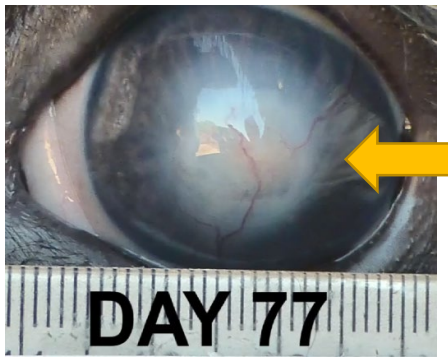






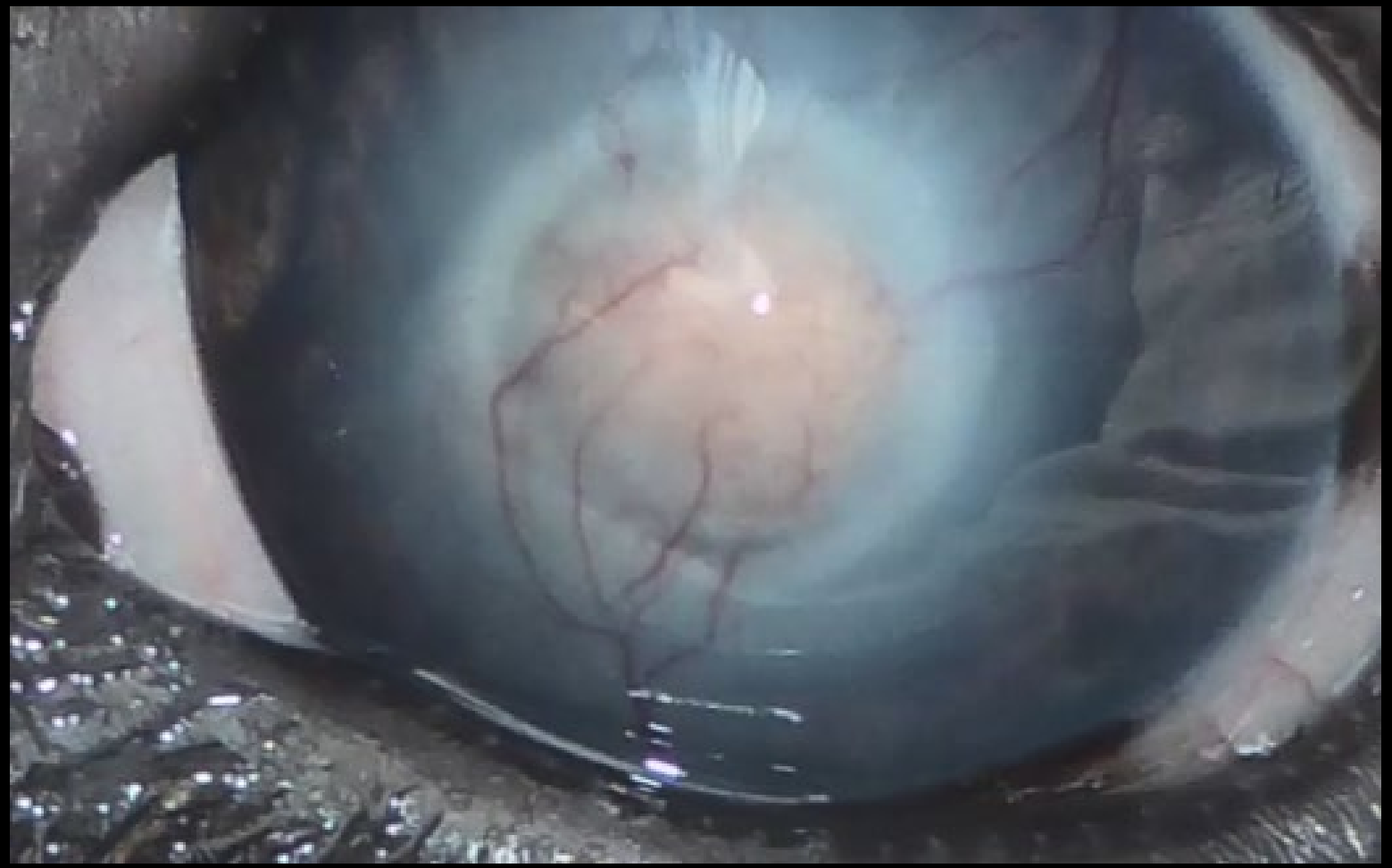
Could argue that Abx not needed here either



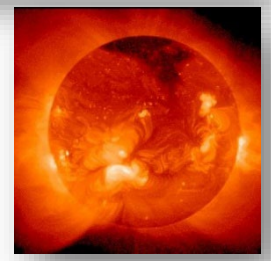


Blood vessels on surface indicate that healing has ALREADY taken place

Antibiotics ARE NOT NECESSARY at this stage!!

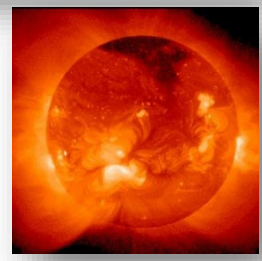


Risk factors for pinkeye…



- Flies (face flies)
- UV exposure & Mechanical trauma (foxtails)
- Breed predisposition (lighter faced animals)
- Trace mineral deficiency (Copper/Selenium)
- Human (iatrogenic) spread (dirty hands/equipment!)
- Other infections (Mycoplasma/IBR/maybe (?) Moraxella bovoculi)

Risk factors for pinkeye…



- Flies
- Mechanical trauma
- Trace mineral deficiency
- Human (iatrogenic) spread
- Other infections

Face Flies

- Important role of face flies in spread of *Moraxella bovis*:
  - **3** d – externally surfaces
  - **2** d – digestive tract

- Good evidence for transmission of *Moraxella bovis* by face flies (in laboratory and field)

Fly control in pastured cattle

Comparison of insecticidal ear tags and ivermectin in a topical formulation for controlling horn flies and face flies (Diptera: Muscidae) on pastured cattle.

Author(s) : Williams, R. E. ; Towell, C. A.

Author Affiliation : Department of Entomology, Purdue University, West Lafayette, IN 47907, USA.

Journal article : Journal of Agricultural Entomology 1992 Vol.9 No.4 pp.283-288 ref.19

Ivermectin pour-on by itself

VS

Permethrin ear tags (10%)
Diazinon ear tags (20%)
Ivermectin plus an ear tag in mid-summer

Best face fly control: permethrin ear tag alone or in combination with ivermectin (but not ivermectin alone)

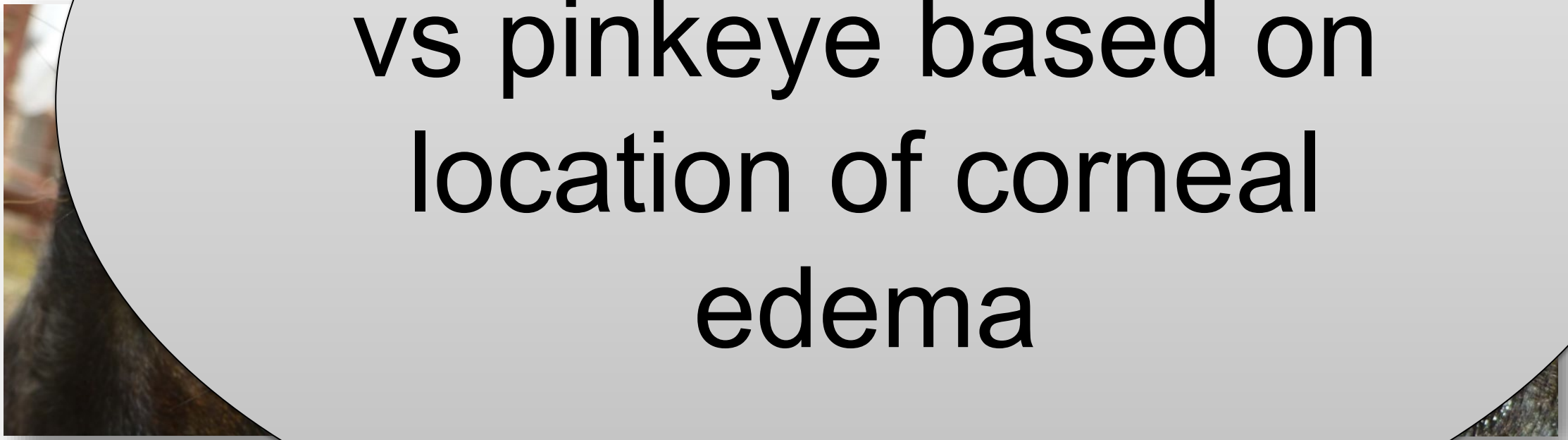
Mechanical trauma

- Damages layer of corneal skin cells
- Believed to facilitate *M bovis* corneal entry/infection

Mechanical trauma

- How to t

Look
foxt



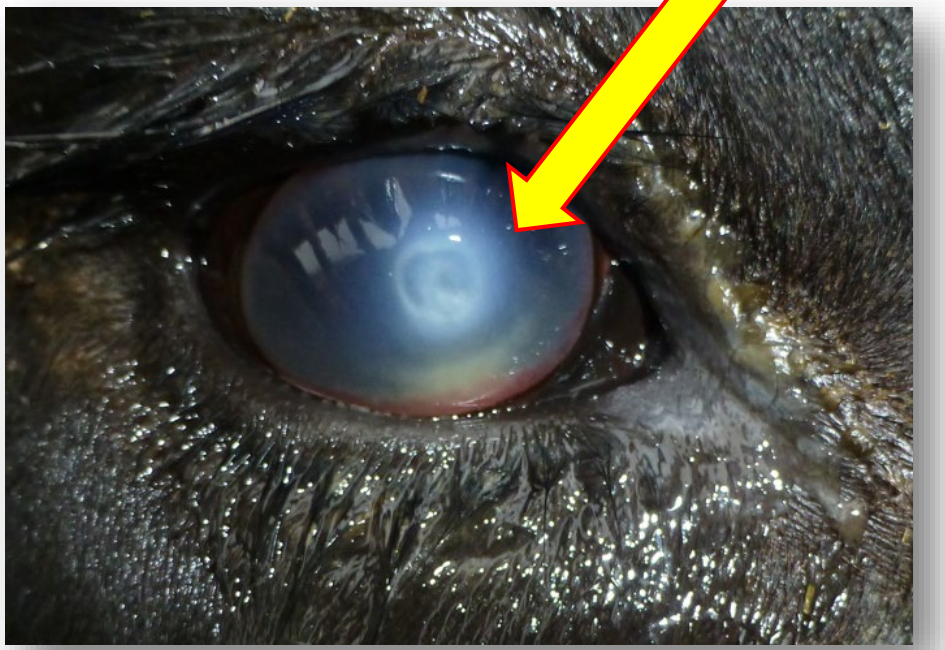
Recognizing a foxtail vs pinkeye based on location of corneal edema

Mechanical trauma

- How to tell pinkeye vs foxtail EARLY on?

Look at pattern of edema-with foxtail, it blends into 'limbus'

With EARLY pinkeye, edema more towards center



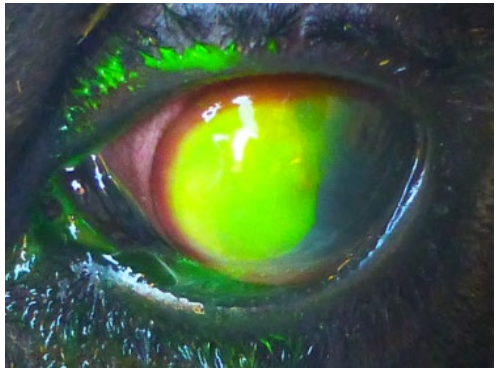
Removing a foxtail…

Tips on foxtail removal- ‘retropulsing’ the eyeball

Treatment following removal of a foxtail?

- Many times eye will heal fine after removing foxtail, but are at risk for getting pinkeye
  - **Could consider no treatment** if able to observe animal frequently
  - May choose Abx if **high economic value** and **don't want to risk** getting pinkeye

- **How to know?**
- Consider how deep the scrape appears…if evidence of blood vessels, you know it has been going on for at least 3-5 days→ consider antibiotics (injectable/topical)

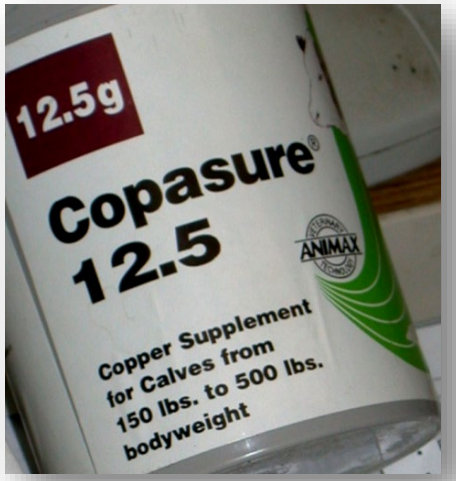


Trace mineral deficiencies - copper, selenium, vitamin E, chromium, vitamin A, cobalt, zinc…others

Considered important for:

- Optimal immune function
- Antioxidant function

- Anecdotal observations
  - Pinkeye problems in copper/selenium deficient herds



- In general: trace mineral supplementation = <u>part of the overall approach to pinkeye prevention</u>

Human (iatrogenic) spread of pinkeye

Don’t be a big face fly!!

- WEAR GLOVES (even APRONS!) WHEN TREATING!
- Disinfect gloves & instruments between calves → chlorhexidine; dilute bleach

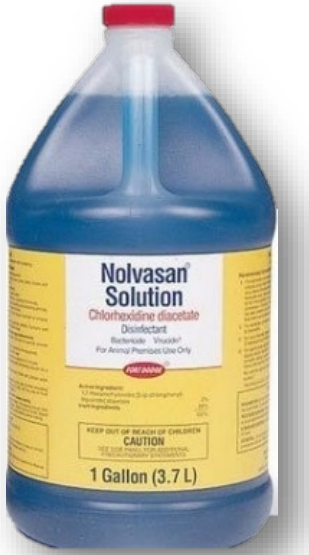
What's wrong with this picture?

What's wrong with this picture?

Should be wearing gloves and disinfecting between animals to reduce spread of infection!

Disinfection

- 0.05% chlorhexidine
  - Stock=2%; ~100 ml/gallon

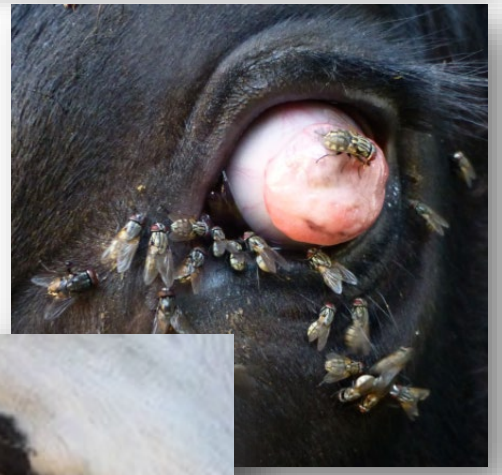


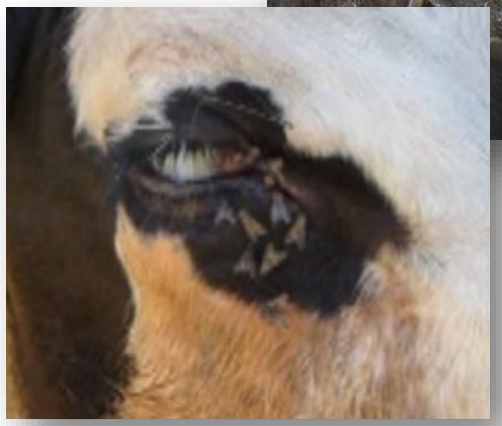
- 10% household bleach:
  - Regular strength bleach→~1-1.5 cups/gal
  - Concentrated bleach→ ~1/2 cup/gal

- Reminder →make fresh daily

Other infections linked to pinkeye

- **Mycoplasma** & **Infectious bovine rhinotracheitis virus** *(IBR)*
  - Increased ocular/nasal discharge
  - More spread of *M. bovis*
  - Immune suppression





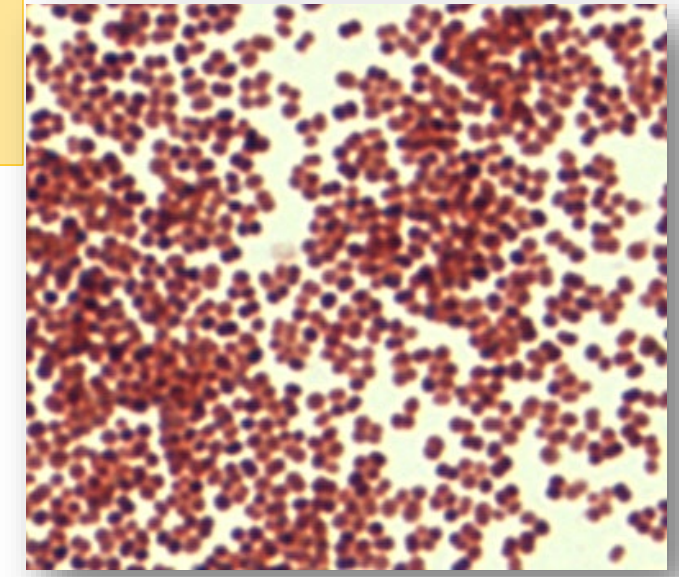
Mycoplasma

WBC ‘apoptosis’ (programmed cell death)

Induces anti-inflammatory cytokines

Suppresses pro-inflammatory cytokines

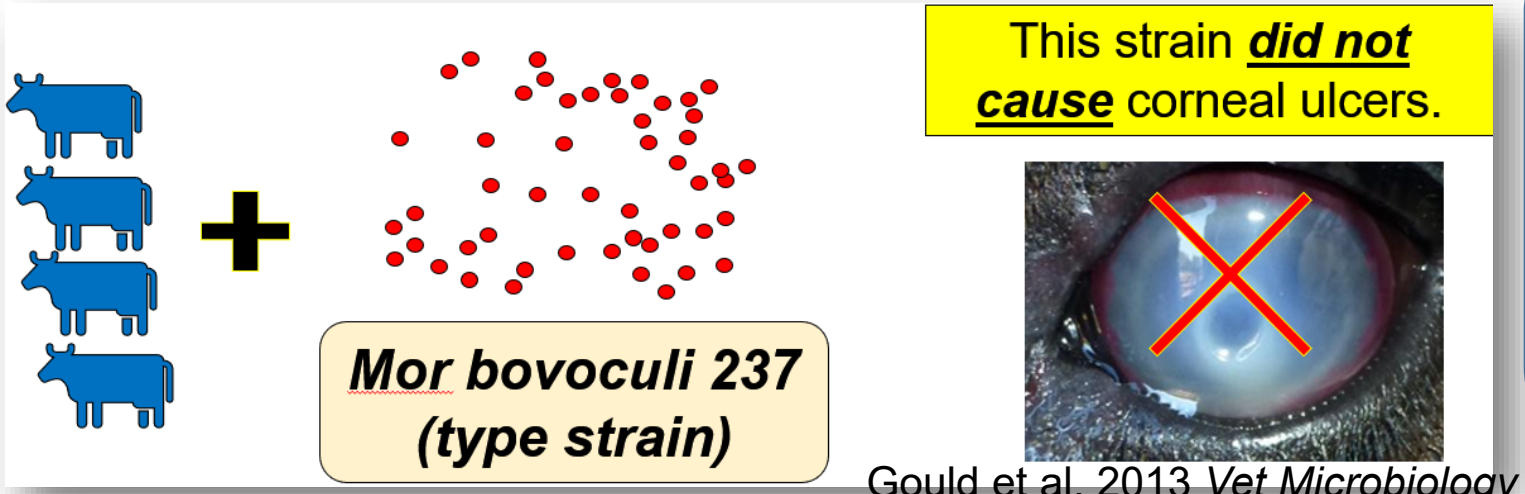
Other Moraxellas linked to pinkeye



Moraxella bovoculi

Facts:

- Discovered in mid-2000's
- Related to *M. bovis*
- Produces cytotoxin (~80% identical to *M. bovis* cytotoxin)
- But…



This strain ***did not cause*** corneal ulcers.

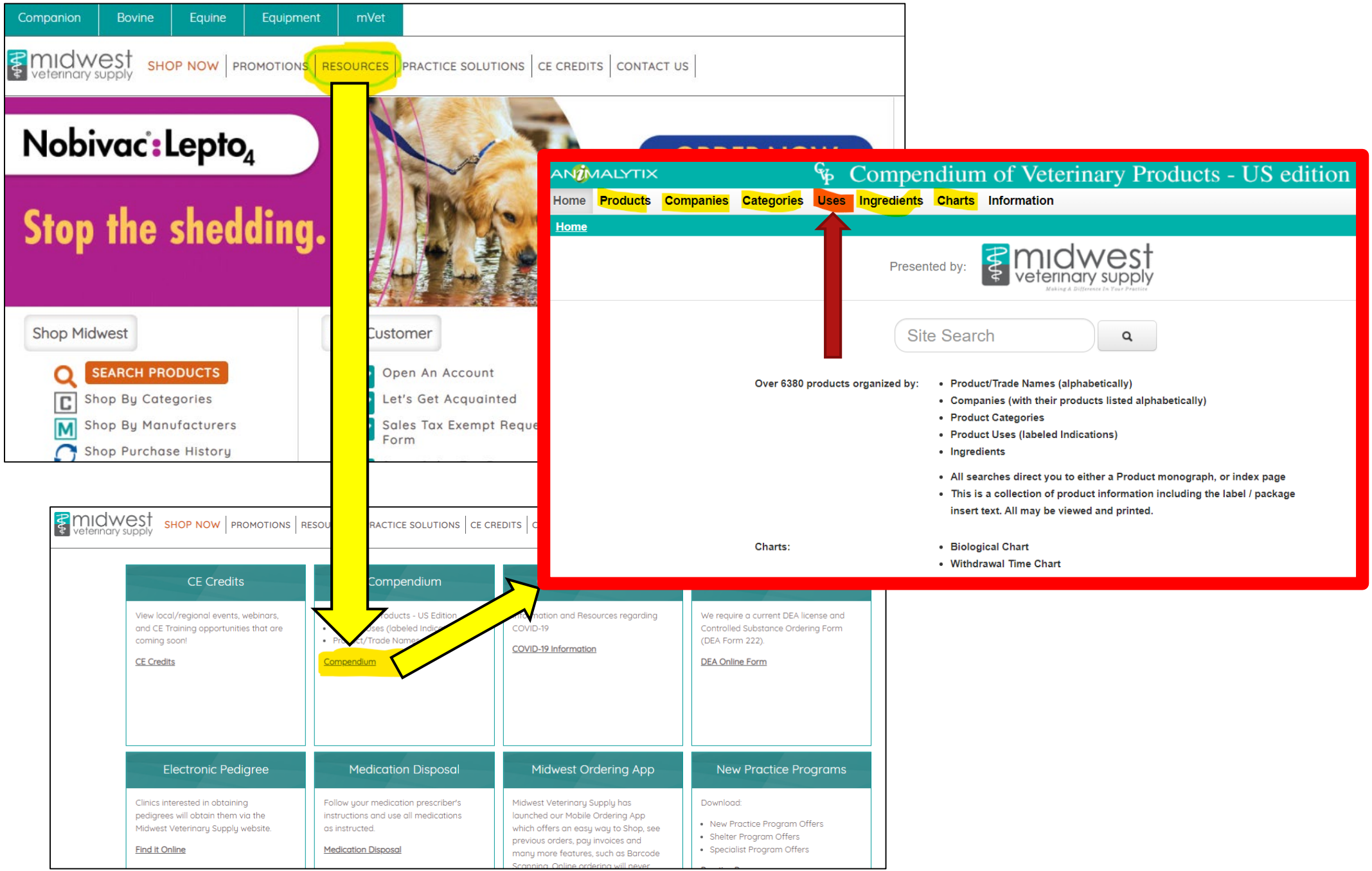
Gould et al. 2013 *Vet Microbiology*

Maybe M. bovoculi is a risk factor for disease…an opportunist?

Question #6

For pinkeye, my go-to treatment is (type your response in the chat).

https://www.midwestvetsupply.com/products/



Treatment- label indications

ANIMALYTIX | Compendium of Veterinary Products - US edition

Home | Products | Companies | Categories | Uses | Ingredients | Charts | Information | Site Search

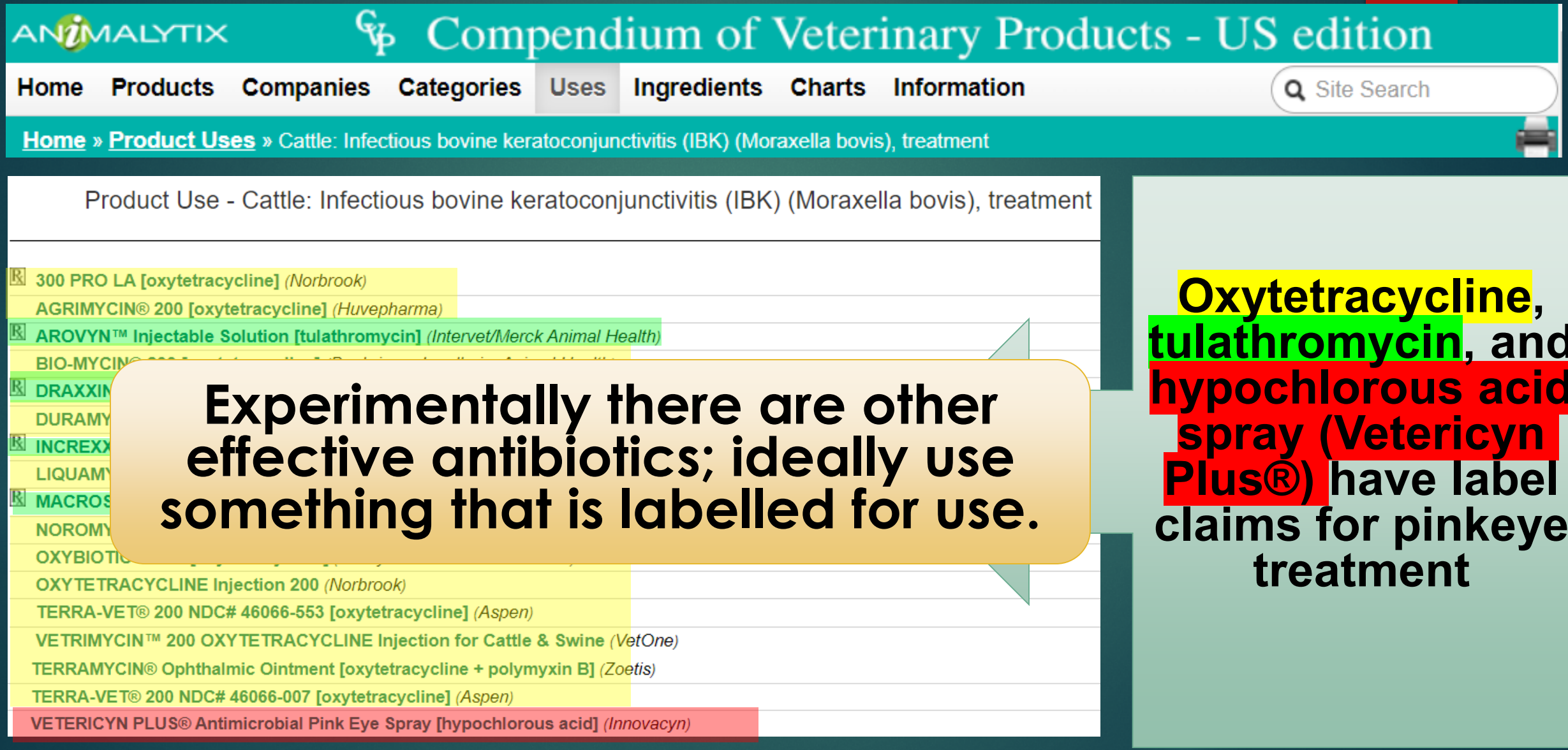
Home » Product Uses » Cattle: Infectious bovine keratoconjunctivitis (IBK) (Moraxella bovis), treatment

Product Use - Cattle: Infectious bovine keratoconjunctivitis (IBK) (Moraxella bovis), treatment

- 300 PRO LA [oxytetracycline] *(Norbrook)*
- AGRIMYCIN® 200 [oxytetracycline] *(Huvepharma)*
- AROVYN™ Injectable Solution [tulathromycin] *(Intervet/Merck Animal Health)*
- BIO-MYCIN® 200 [oxytetracycline] *(Boehringer Ingelheim Animal Health)*
- DRAXXIN® Injectable Solution [tulathromycin] *(Zoetis)*
- DURAMYCIN 72-200 [oxytetracycline] *(Durvet)*
- INCREXXA™ [tulathromycin] *(Elanco US)*
- LIQUAMYCIN® LA-200® [oxytetracycline] *(Zoetis)*
- MACROSYN™ Injectable Solution [tulathromycin] *(Bimeda)*
- NOROMYCIN 300 LA [oxytetracycline] *(Norbrook)*
- OXYBIOTIC™-200 [oxytetracycline] *(Henry Schein® Animal Health)*
- OXYTETRACYCLINE Injection 200 *(Norbrook)*
- TERRA-VET® 200 NDC# 46066-553 [oxytetracycline] *(Aspen)*
- VETRIMYCIN™ 200 OXYTETRACYCLINE Injection for Cattle & Swine *(VetOne)*
- TERRAMYCIN® Ophthalmic Ointment [oxytetracycline + polymyxin B] *(Zoetis)*
- TERRA-VET® 200 NDC# 46066-007 [oxytetracycline] *(Aspen)*
- VETERICYN PLUS® Antimicrobial Pink Eye Spray [hypochlorous acid] *(Innovacyn)*

Oxytetracycline, tulathromycin, and hypochlorous acid spray (Vetericyn Plus®) have label claims for pinkeye treatment

Treatment- label indications



Experimentally there are other effective antibiotics; ideally use something that is labelled for use.

Oxytetracycline, tulathromycin, and hypochlorous acid spray (Vetericyn Plus®) have label claims for pinkeye treatment

Preliminary evaluation of hypochlorous acid spray for treatment of experimentally induced infectious bovine keratoconjunctivitis.

Bovine Practictioner, 2016

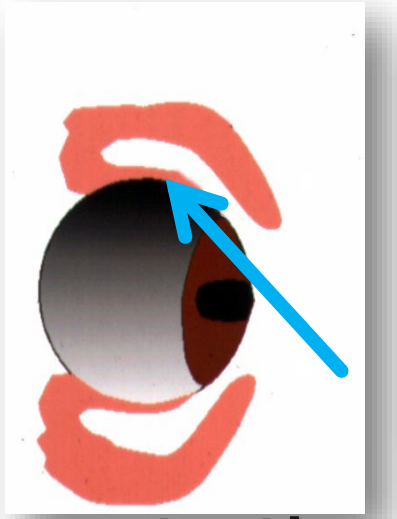
Author(s) : Gard, J.; Taylor, D.; Maloney, R.; Schnuelle, M.; Duran, S.; Moore, P.; Justus, W.; Walz, P.; Stockle, R.; Rodning, S.; DeGraves, F.; Santen, E. van; Edmondson, M.;

VETERICYN PLUS® PINK EYE SPRAY
Innovacyn

Active Ingredient: 0.015% Hypochlorous Acid

Results: hypochlorous acid spray reduced pain, infection, and healing time of corneal lesions in calves experimentally infected with *M. bovis*

IBK Treatments: Subconjunctival PPG



- 5x minimum bactericidal concentration in tears x ~35 hours w/1 ml PPG
- Tip: drop 0.1-0.5 ml on corneal surface first (procaine)

- Subconjunctival dexamethasone?
  - Did not affect outcome Allen, JAVMA 1995

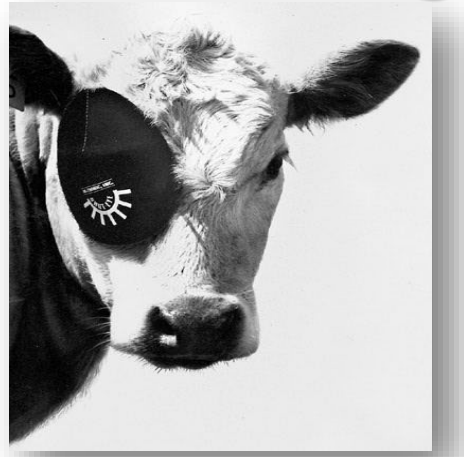
Other IBK treatments: To patch or not?

Effects of eye patches on corneal ulcer healing and weight gain in stocker steers on pasture: a randomized controlled trial

Gabriele U. Maier,[†,1,] Josh S. Davy,[‡] Larry C. Forero,[‖] Heejung Bang,[§] Kristin Clothier,[¶] and John A. Angelos[**]

Transl. Anim. Sci. 2021.5:1-9; https://doi.org/10.1093/tas/txab162

- Patched eyes healed faster (median healing time was 4 days faster)



- Placement tips:
  - Open at bottom for drainage/air circulation; check eyes at least 2x per week!

Other non-antibiotic Treatments for Pinkeye?

Effective?

- Patient serum
  - Frequent application
- Some (many more!):
  - Condensed milk?
  - Dilute povidone iodine?

Povidone Iodine?

Anecdotal report - diluted betadine
What about in human medicine?

Report

The Ocular Application of Povidone-Iodine

Sherwin J Isenberg MD
Leonard Apt MD

Community Eye Health *Vol 16 No. 46* 2003

Clinical & Experimental Ophthalmology

Papanikolaou et al. J Clinic Experiment Ophthalmol 2011, 2:1
http://dx.doi.org/10.4172/2155-9570.1000125

Research Article Open Access

Tolerability and Safety Profile of Povidone Iodine in Pre-Operative Skin and Eye Disinfection Prior to Intraocular Surgery

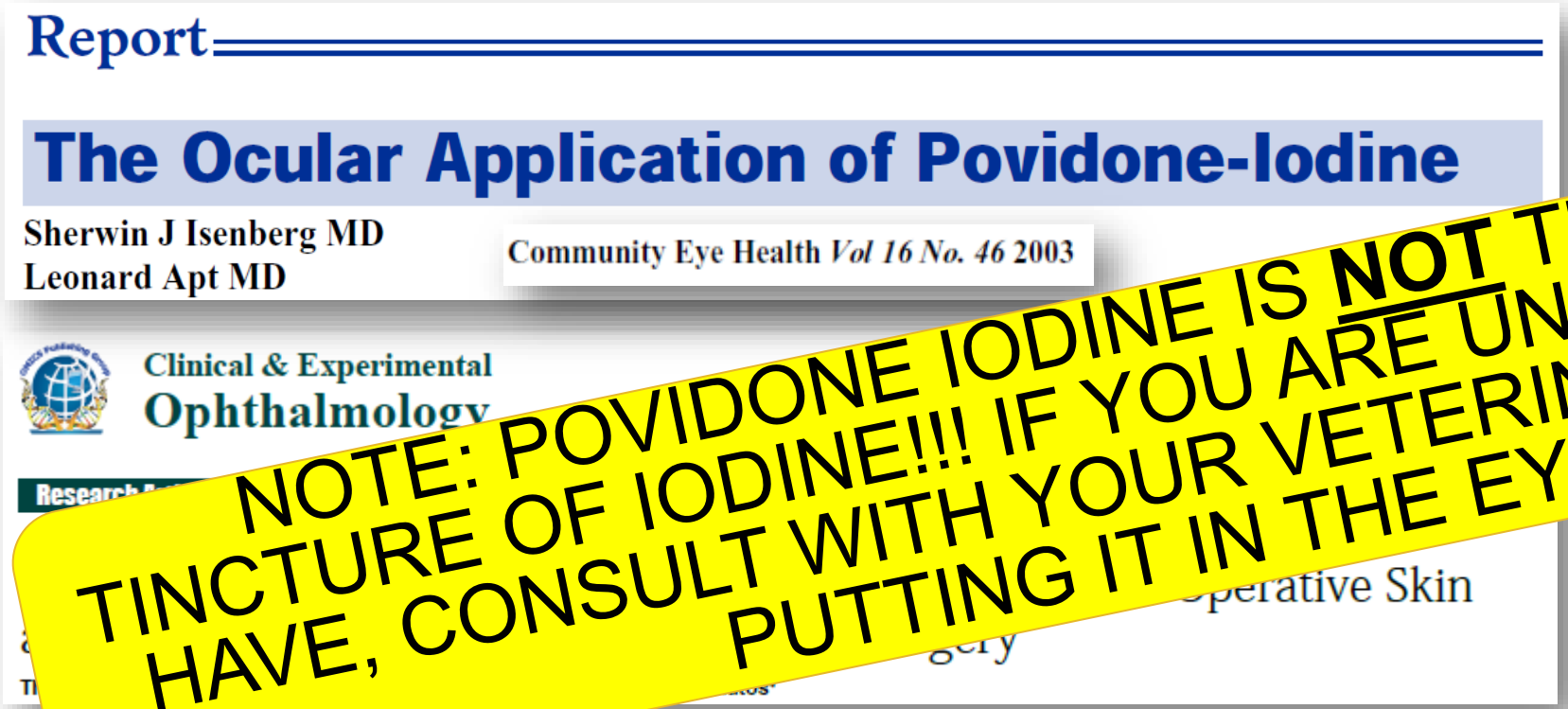
Theocharis Papanikolaou[1*], Tahir Islam[2] and Adnan Hashim[3], George Mariatos[4]

5% Povidone Iodine (made by diluting a 10% solution 50:50 with normal saline)

But…no published studies yet on efficacy against pinkeye!

Povidone Iodine?

Anecdotal report - diluted betadine
What about in human medicine?



Report

The Ocular Application of Povidone-Iodine

Sherwin J Isenberg MD
Leonard Apt MD

Community Eye Health *Vol 16 No. 46* 2003

Clinical & Experimental
Ophthalmology

perative Skin

NOTE: POVIDONE IODINE IS **NOT** THE SAME AS TINCTURE OF IODINE!!! IF YOU ARE UNSURE WHAT YOU HAVE, CONSULT WITH YOUR VETERINARIAN BEFORE PUTTING IT IN THE EYE.

studies yet on efficacy against pinkeye!

5% Povidone Iodine (made by diluting a 10% solution 50:50 with normal saline)

Vaccination against Pinkeye

Zoom poll Question #3

I vaccinate against pinkeye…

A) never
B) sometimes, but not every year
C) every year
D) not sure (not my job)
E) just here to learn!

Zoom poll Question #4

For pinkeye prevention this year I am using (or plan to use):

A) a commercial vaccine(s)
B) an autogenous vaccine(s)
C) both commercial & autogenous vaccines
D) not sure (not my job)
E) just here to learn!

Zoom poll Question #5

I feel like the pinkeye vaccine(s) I use:

A) work really well
B) work so-so, but overall some benefit
C) don’t work at all
D) not sure how well they work (not my job)
E) just here to learn!

Pinkeye vaccines

- **Autogenous *M bovis***
- **Autogenous *M bovoculi***
- **Commercial *M bovis***
- **Commercial (conditionally licensed) *M bovoculi***

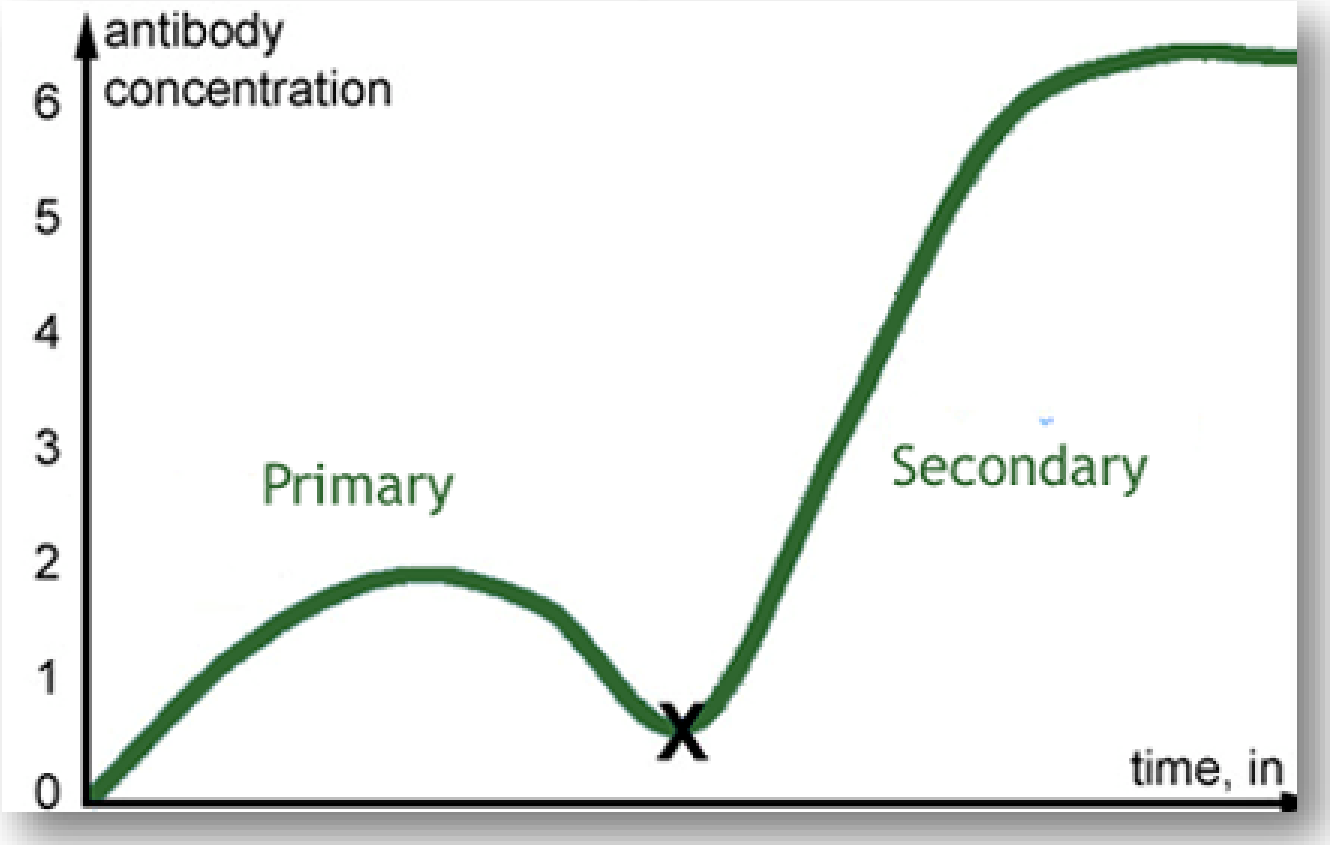
In published randomized controlled field trials, these vaccines were not found to prevent IBK

However….

- Anecdotal reports of benefits from vaccines & personal experience suggest there can be benefits from vaccination
- In my opinion: vaccination can be an important component of an overall pinkeye prevention program.

General Pinkeye Vaccine Recommendations

- Start vaccinating <u>at least</u> 4 weeks BEFORE you expect the first cases!
- Boost as indicated! Usually 3-4 weeks



General Pinkeye Vaccine Recommendations

- **Least expensive:** commercial *M bovis* or *M bovoculi* vaccine
- **If breaks:**
  - consider switching to…
    - a different commercial product
    - an autogenous vaccine based on eye swabs
    - a commercial *M bovis* with autogenous *M bovoculi* (or vice versa)
- **If switching commercial products, consider *M bovis* strain (if listed)**

LIST OF PINKEYE VACCINES – MARCH 2022
From the *Compendium of Veterinary Products*

Handout provides a summary of each

Product Use - Cattle: Pinkeye (Moraxella spp), immunization

ALPHA-7/MB-1® *(Boehringer Ingelheim Animal Health)*

BOVILIS® 20/20 VISION® 7 with SPUR® *(Intervet/Merck Animal Health)*

BOVILIS® PILIGUARD® PINKEYE+7 *(Intervet/Merck Animal Health)*

MAXI/GUARD® PINKEYE Bacterin *(Addison)*

MORAXELLA BOVOCULI Bacterin *(Addison)*

MORAXELLA BOVOCULI Bacterin *(Intervet/Merck Animal Health)*

OCU-GUARD® MB-1 *(Boehringer Ingelheim Animal Health)*

PILIGUARD® PINKEYE-1 TRIVALENT *(Intervet/Merck Animal Health)*

PILIGUARD® PINKEYE + 7 *(Intervet/Merck Animal Health)*

PILIGUARD® PINKEYE TRIVIEW® *(Intervet/Merck Animal Health)*

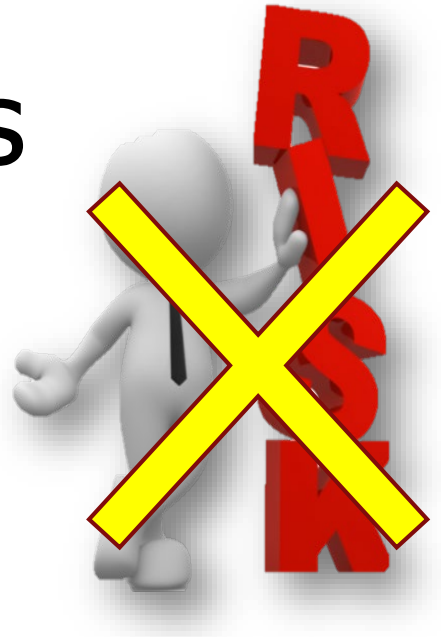
PINKEYE SHIELD™ XT4 *(Elanco US (Farm Animal))*

SOLIDBAC® PINKEYE IR/PR *(Zoetis)*

Some clostridial coverage (note: NOT tetanus)

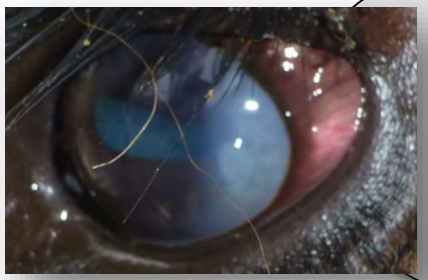
An overall pinkeye control program

- Consider ways to minimize risk factors
  - Trace mineral supplementation
  - Fly control
  - Other infections
  - Clipping pastures
  - Vaccination

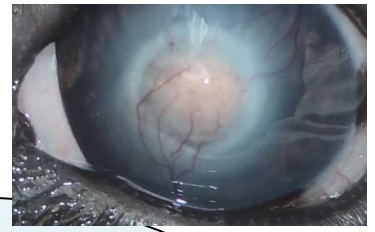


Learning Objectives

Recognize

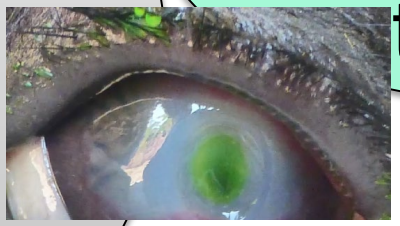


foxtail vs pinkeye based on location of corneal edema

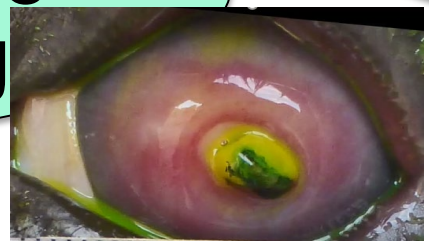


when antibiotic treatment <u>is not</u> necessary

Understand basic cow **eye anatomy** & **what happens during pinkeye**



when the eyeball is close to perforating



Know different options for treatment and prevention of pinkeye

Some questions previously submitted during registration:

- Vaccine load at marking when including Pink Eye with BRD, 8-Way, Wormer, etc.? Good and bad of it. [unaware of studies that have directly compared responses/animal safety etc of Pinkeye vaccines with or without other vaccines/dewormers etc- I would not expect problems unless giving multiple vaccines containing endotoxin on hot days]
- How best do I utilize pink eye vaccines and treatments? [likely depends a lot on $, level of problem in the herd etc]
- What are best vaccines for pinkeye, are autogenous vaccines more efficacious? [responses to vaccines can be very herd specific- if just starting to vaccinate, a commercial M. bovis or M. bovoculi would be where I would start and see if it works]
- Organic Cattle pink eye treatment options [perhaps consider diluted povidone iodine…Vetericyn if allowed?)]
- How to prevent pinkeye [control risk factors…fly control…trace minerals…clipping pastures if feasible to reduce foxtails…vaccines]
- Pink eye management when vaccination prior to exposure not feasible. [I would focus on minimizing risk factors]

Other questions?

jaangelos@ucdavis.edu