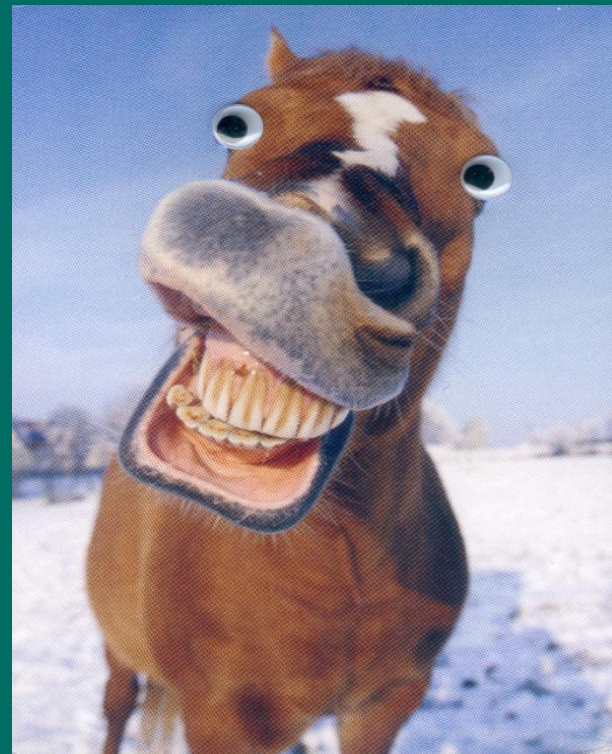
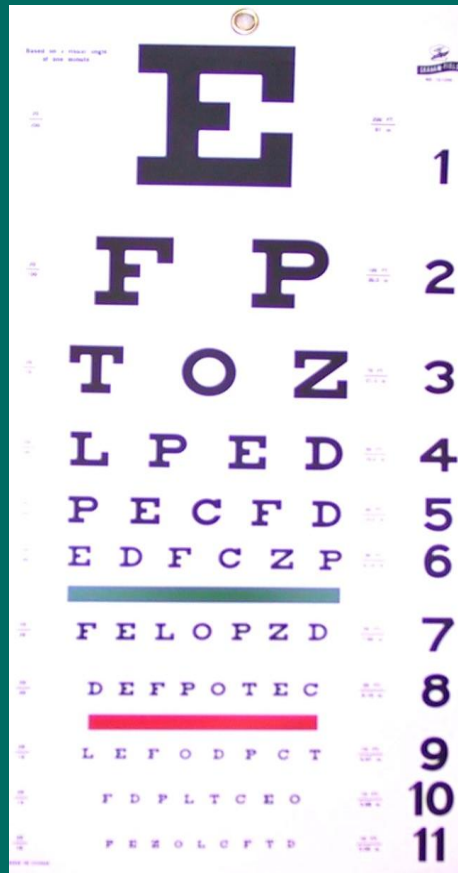




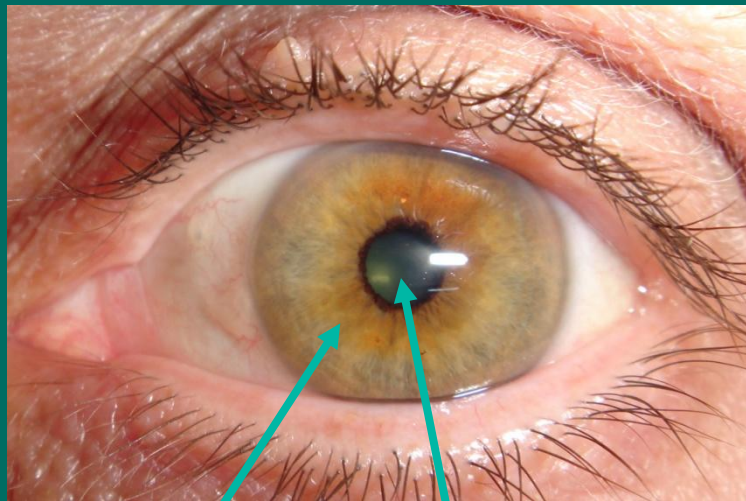
# Vision and Retinal Problems in Horses

Equine Ophthalmology Service  
University of Florida

# Equine Vision: Just what do they see?



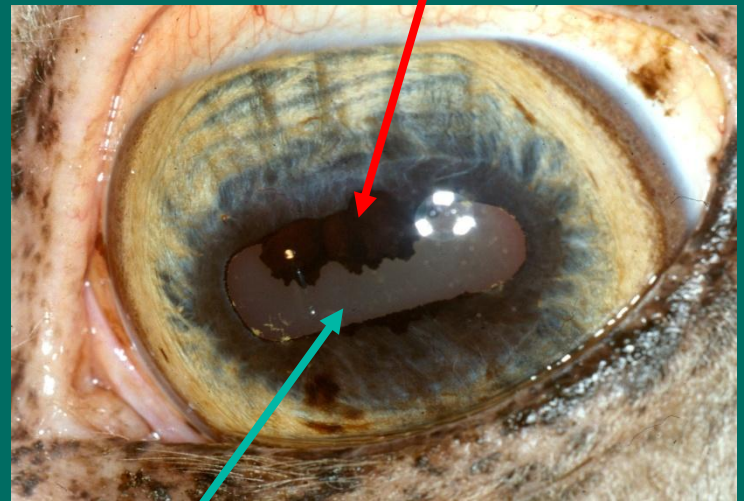
# Anatomy of the eye



**IRIS**

**PUPIL**

**'GRANULAE IRIDICA'**

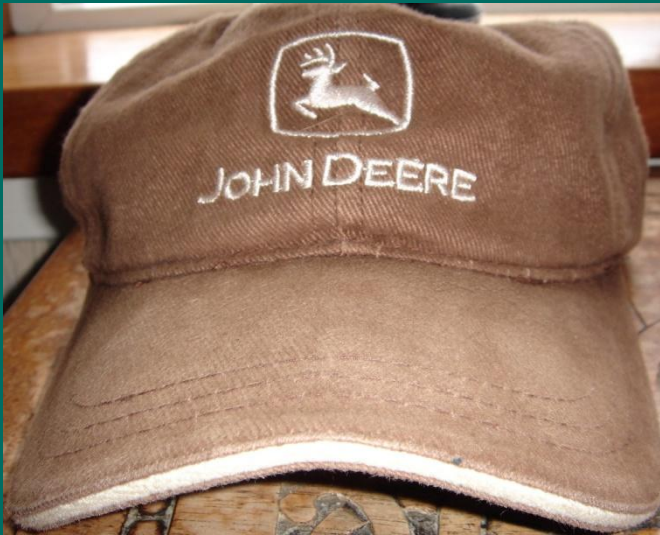


**FLATTENED 'OVAL' PUPIL**



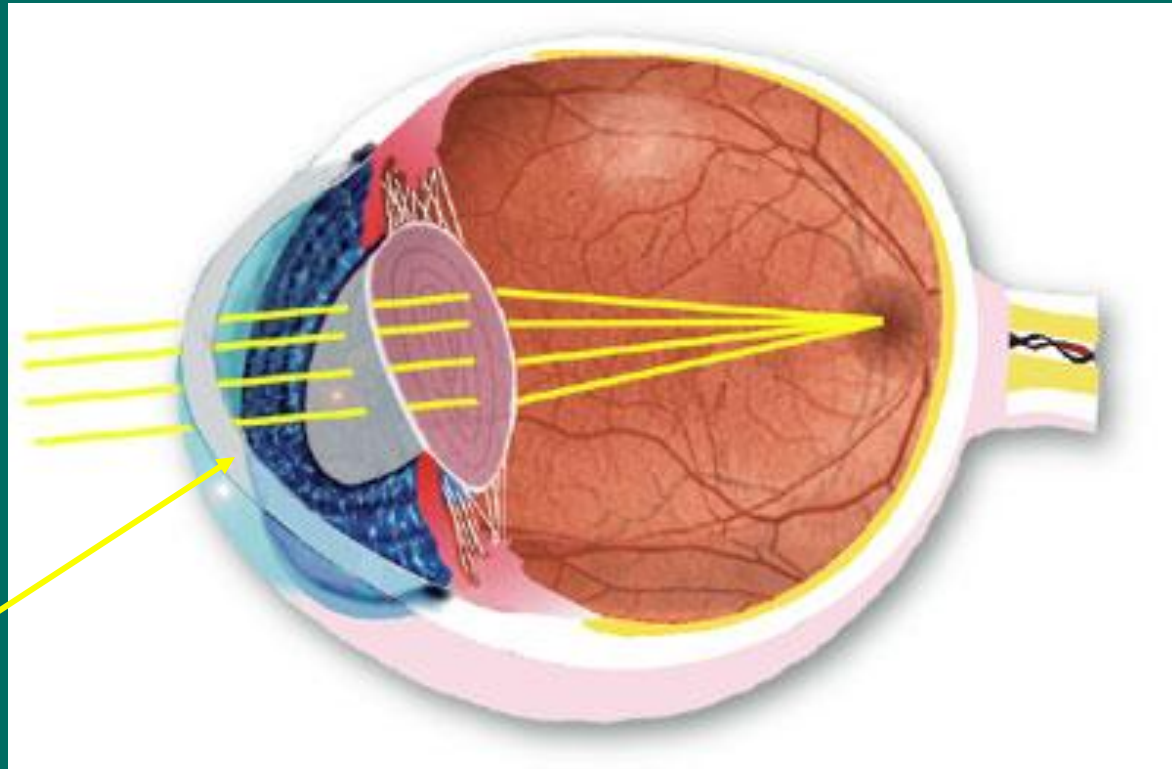
# Anatomy of the eye

‘GRANULAE IRIDICA’





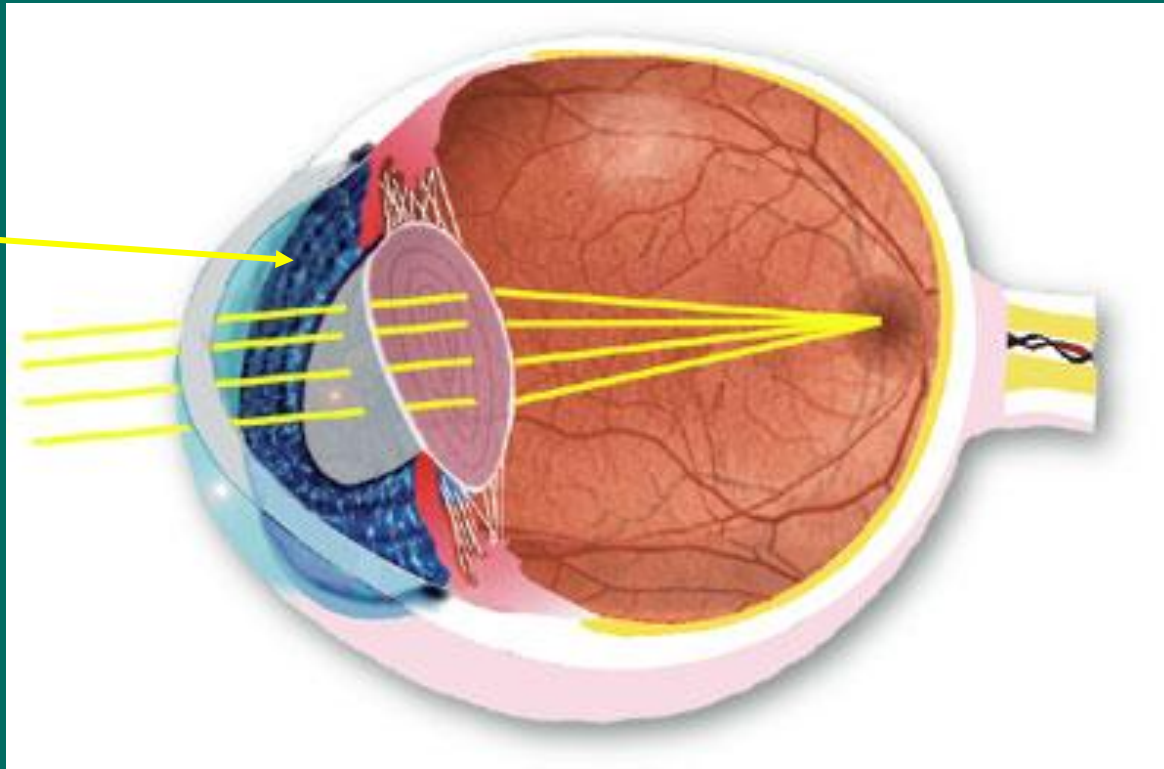
# Anatomy of the eye



Cornea

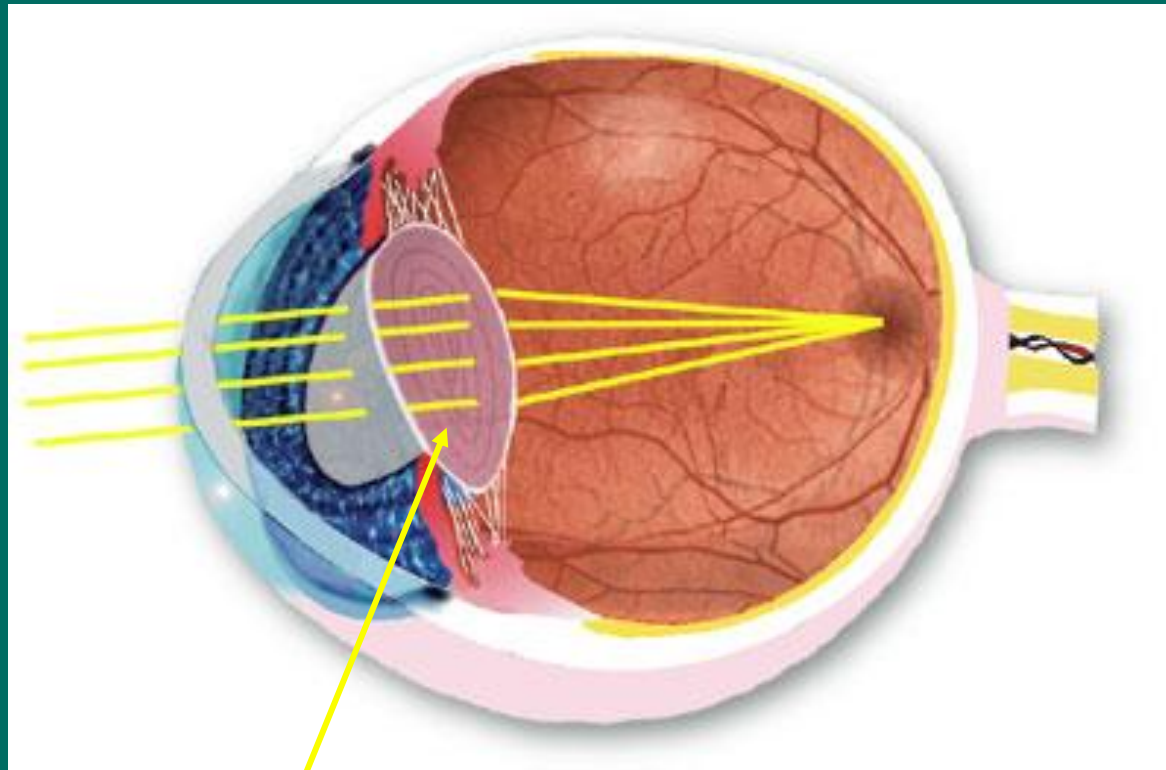
# Anatomy of the eye

Iris



Acts as shutter  
to control light  
entering the eye

# Anatomy of the eye



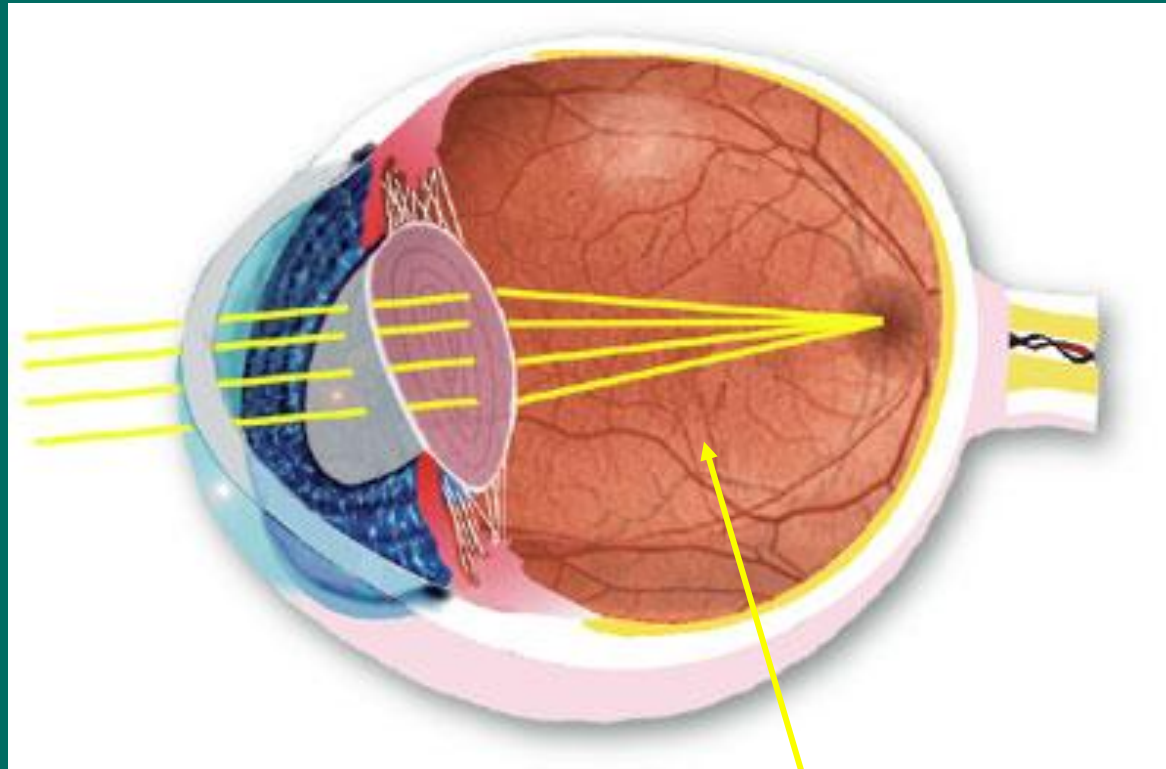
**Lens**

Changes shape to focus light onto back of the eye.

Limited focusing ability in horse



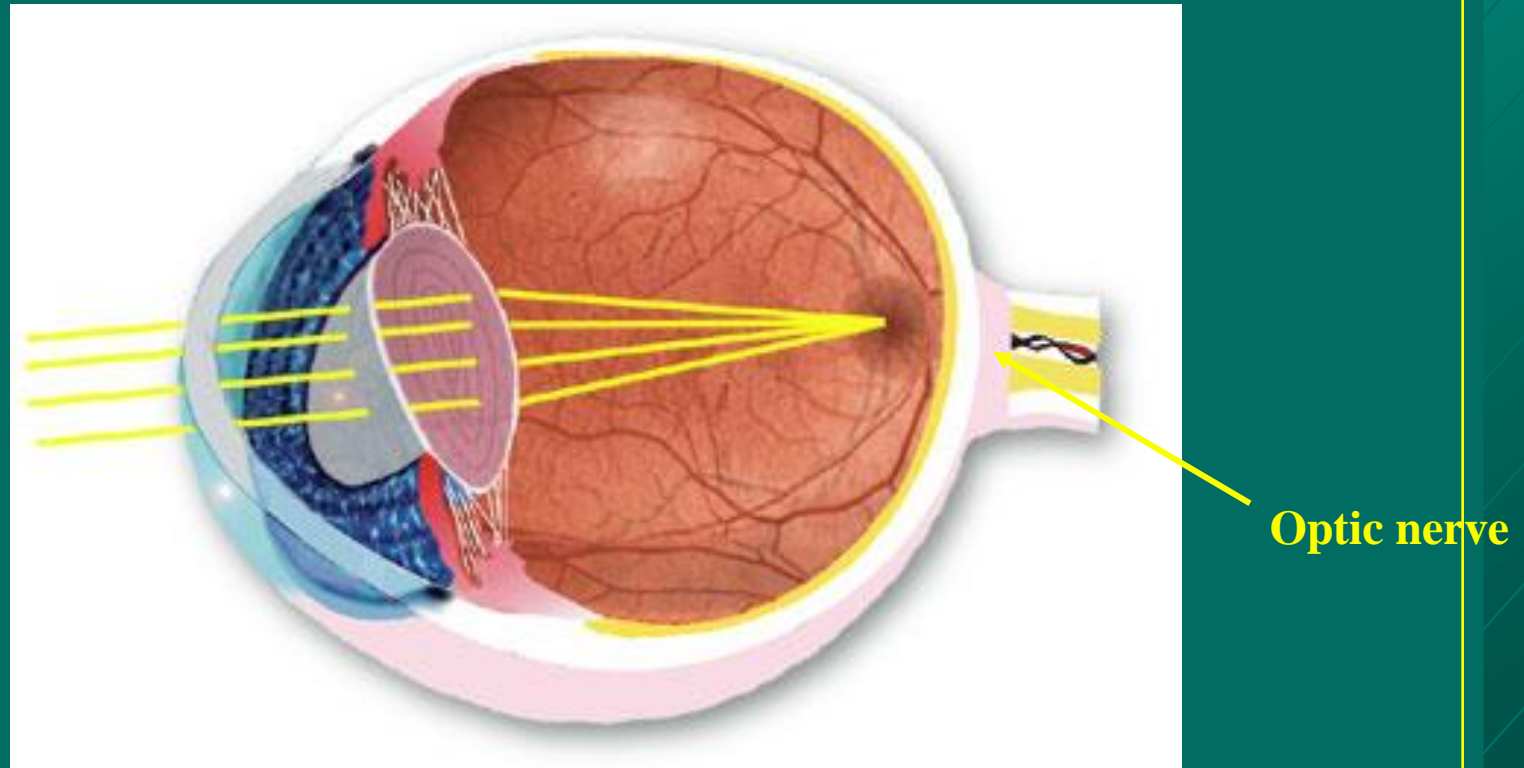
# Anatomy of the eye



Receptors stimulated by  
light: create electrical  
signals

**Retina**

# Anatomy of the eye



Gather electrical signals from retina and carry them to the brain. HENCE VISION

# Equine Vision: What do they see?

What does evolution require them to see?





# Equine Vision: What do they see?

They need to have.....

- Wide panoramic vision
- Good vision in low light
- Detect motion

# Equine Vision:

## What do they see?

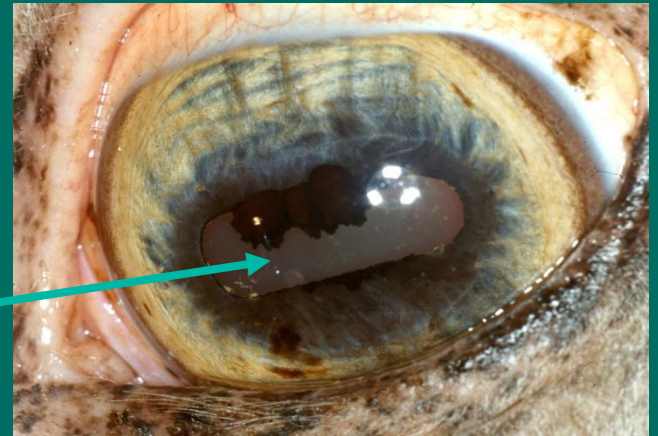
They need to have.....

- Wide panoramic vision
- Good vision in low light
- Detect motion
- 'Acuity' (Sharpness) not that important
- Binocular vision not that important
- Color not that important

# Wide Panoramic Vision - Visual Field

Remember:

- Flattened 'oval' pupil

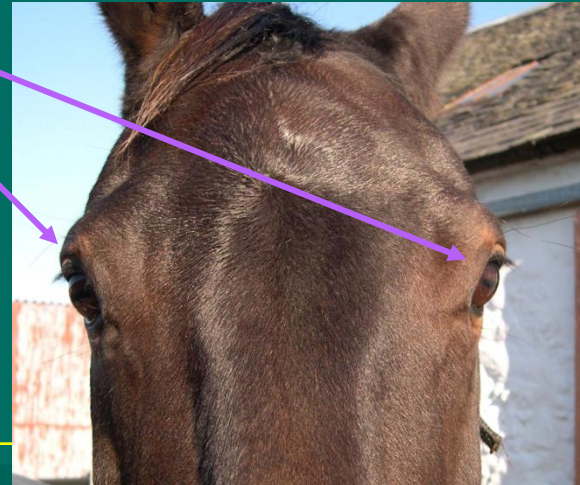
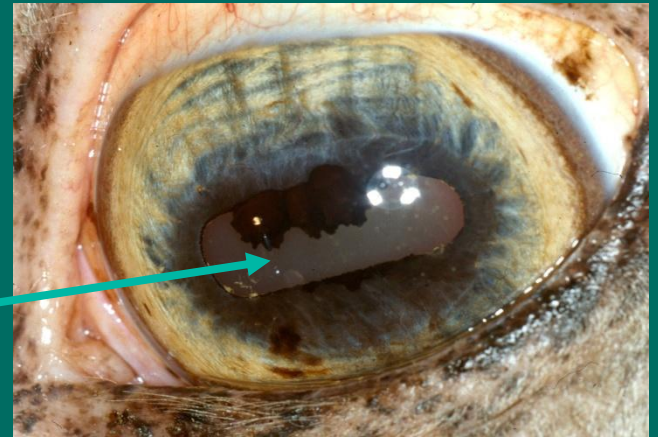




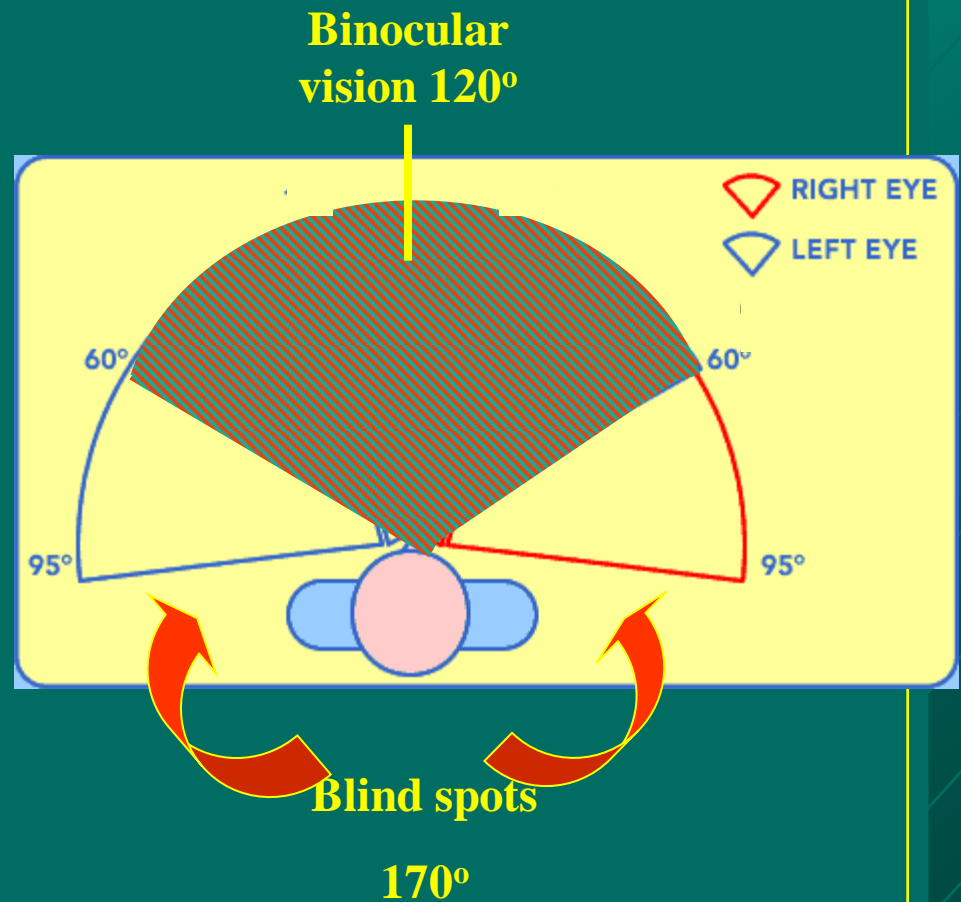
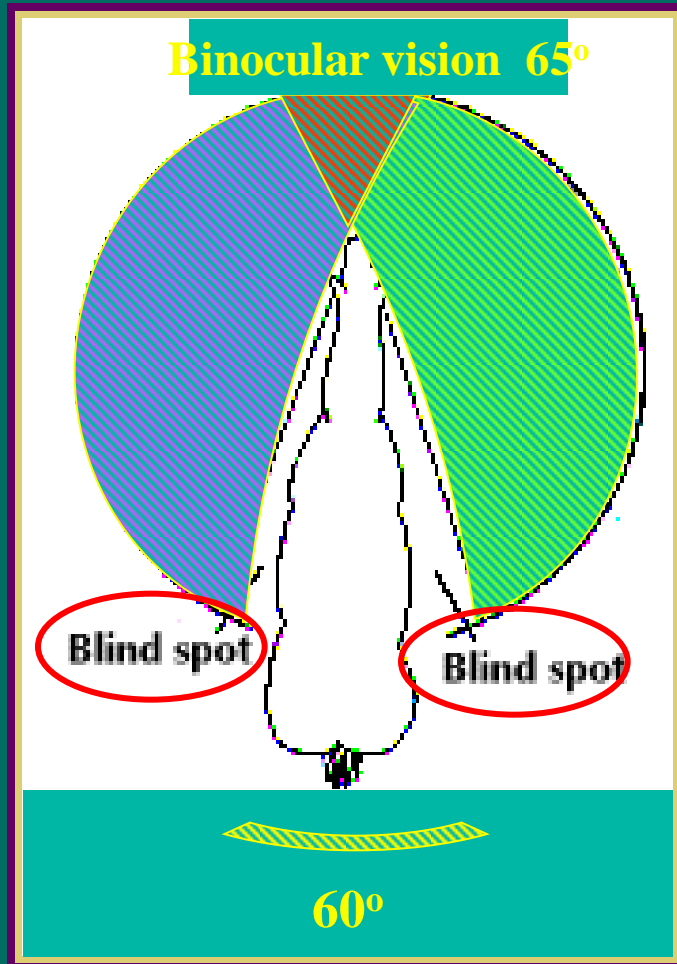
# Wide Panoramic Vision - Visual Field

Remember:

- Flattened 'oval' pupil
- Eyes on side of head



# Visual Field



# Visual Field

Human  
field of  
vision



# Visual Field

Horse field of vision



Human  
field of  
vision



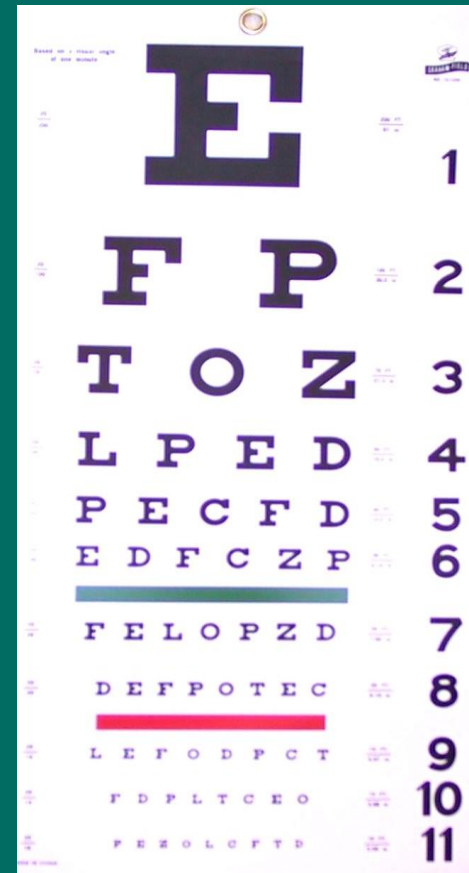


# Visual Acuity

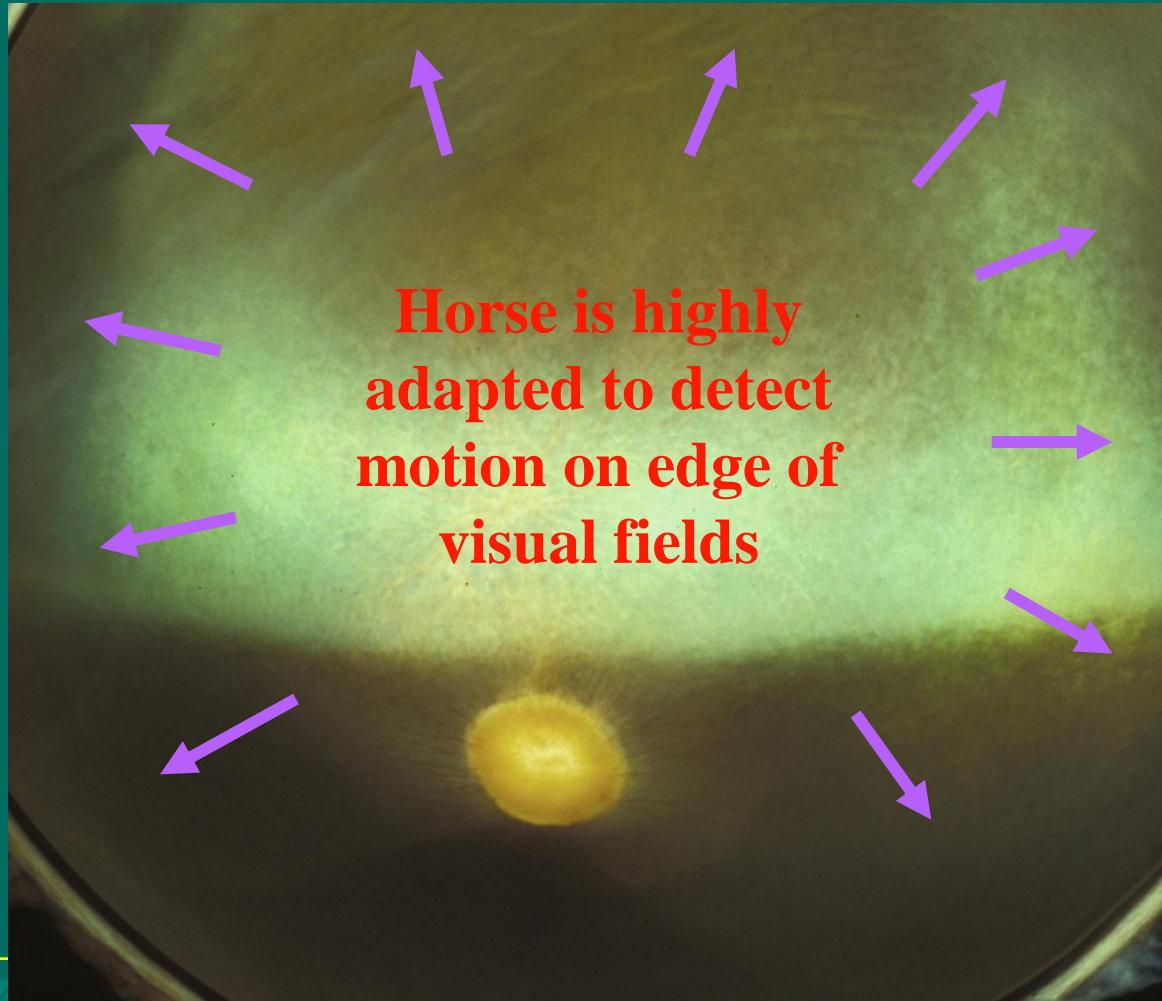
## - Sharpness of Vision



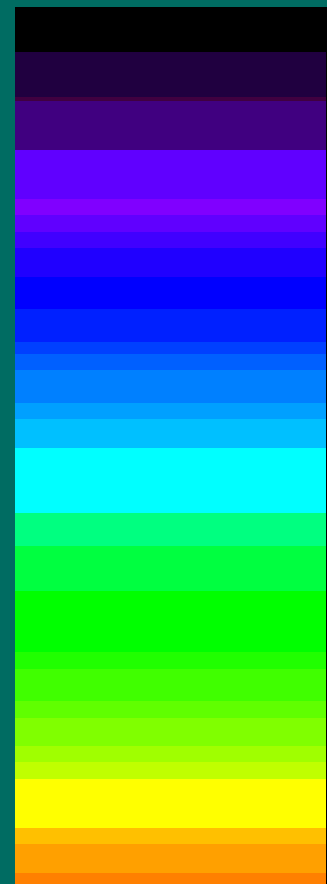
If you can see an object clearly from 50 feet away, a horse would need to be 20 feet away to see that object in the same detail



# Detection of Motion



# Equine Color Vision

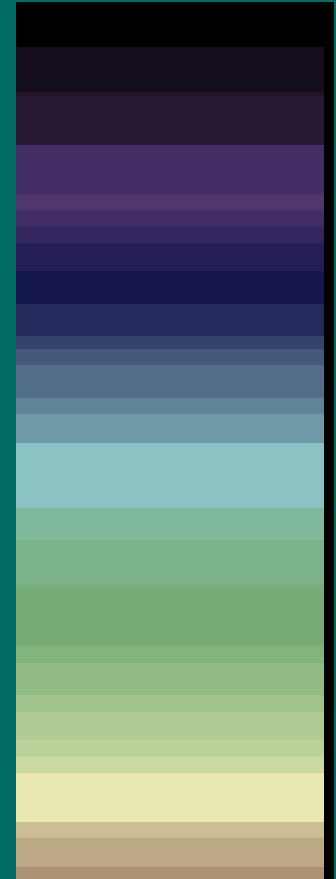




# Equine Color Vision



Colors appear 'washed out'







# Can we test a horse's vision?

- If it is completely blind....Yes

# Can we test a horse's vision?

- If it is completely blind....Yes
- Because it walks into things!



# Can we test a horse's vision?

- If it is completely blind....Yes
- Because it walks into things!
- Otherwise....Not objectively!



# Can we test a horse's vision?

- If it is completely blind....Yes
- Because it walks into things!
- Otherwise....Not objectively!

OBSTACLE COURSES ??



# Can we test a horse's vision?

- If it is completely blind....Yes
- Because it walks into things!
- Otherwise....Not objectively!

## ‘MENACE’ TESTING

If horse reacts: *ie.* a positive test



Figure 2: The menace reflex

Tells us the horse has, at a minimum, 20\20000 vision

Which is vision 100x worse than what, in man, is legally blind!

# Can we test a horse's vision?

- If it is completely blind....Yes
- Because it walks into things!
- Otherwise....Not objectively!

~~‘MENACE TESTING~~

If horse doesn't react: *ie.* a negative test

Tells us the horse probably couldn't care less!!



# Can we test a horse's vision?

- If it is completely blind....Yes
- Because it walks into things!
- Otherwise....Not objectively!
- Horses with severe and extensive eye disease show no apparent difficulty in “seeing”!
- This is one of life's mysteries.....



# Can we test a horse's vision?



# Can we test a horse's vision?

## The most we can say is...

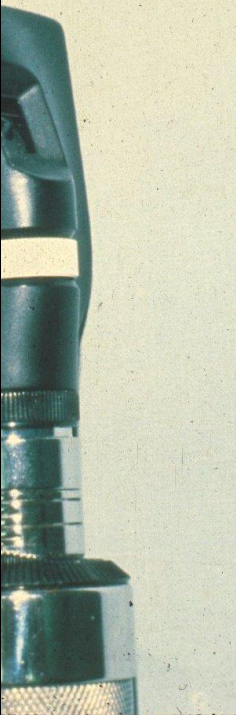
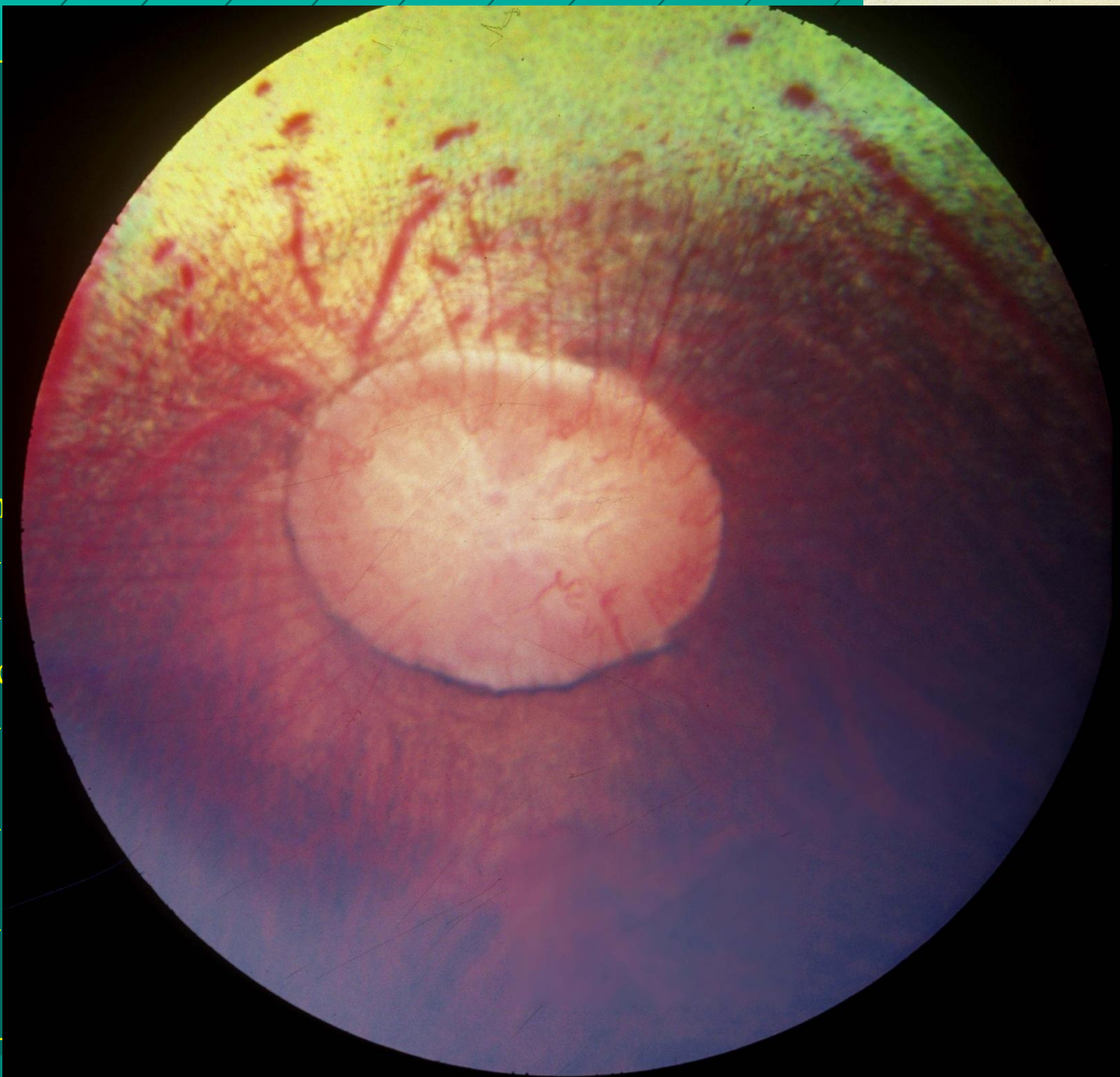
- That from examining the eye...



- This eye has an abnormality or disease which is damaging eye function...and therefore
- A visual deficit is present in this horse
  - Either: This is a major problem, and is likely to affect behaviour and safety of horse and rider
  - Or: This is a minor problem and is, on balance of probability, of no consequence
- But there are often ‘in betweens’.

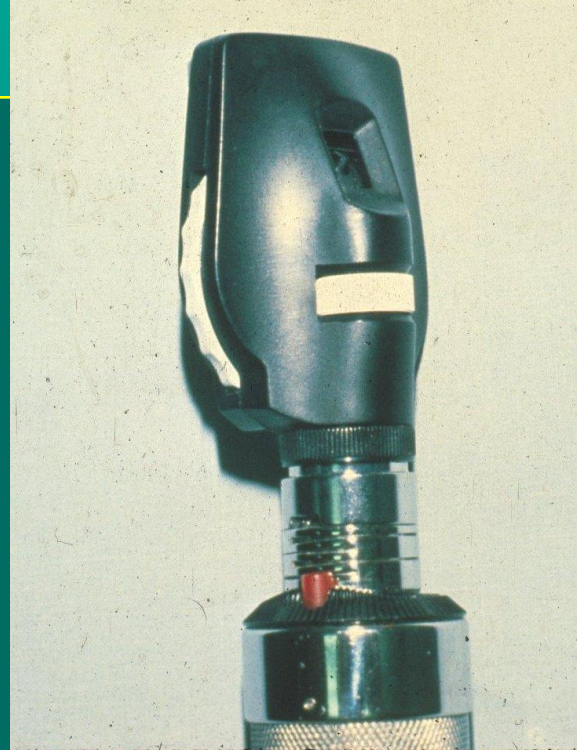


- The
- Inc



# Ophthalmoscopy



- The direct ophthalmoscope:
  - lateral magnification: 7.9X
  - axial magnification: 84X
- Indirect ophthalmoscopy:
  - 5.5 D lens: 3.86X lateral and 20.1X axial
  - 14 D lens: 1.18X lateral and 1.86X axial
  - 20 D lens: 0.79X and 0.84X lateral and axial respectively.

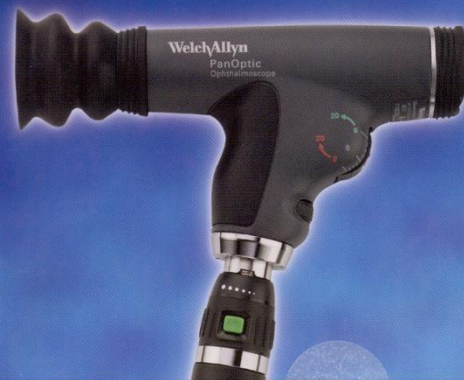




# PanOptic™

Ophthalmoscope

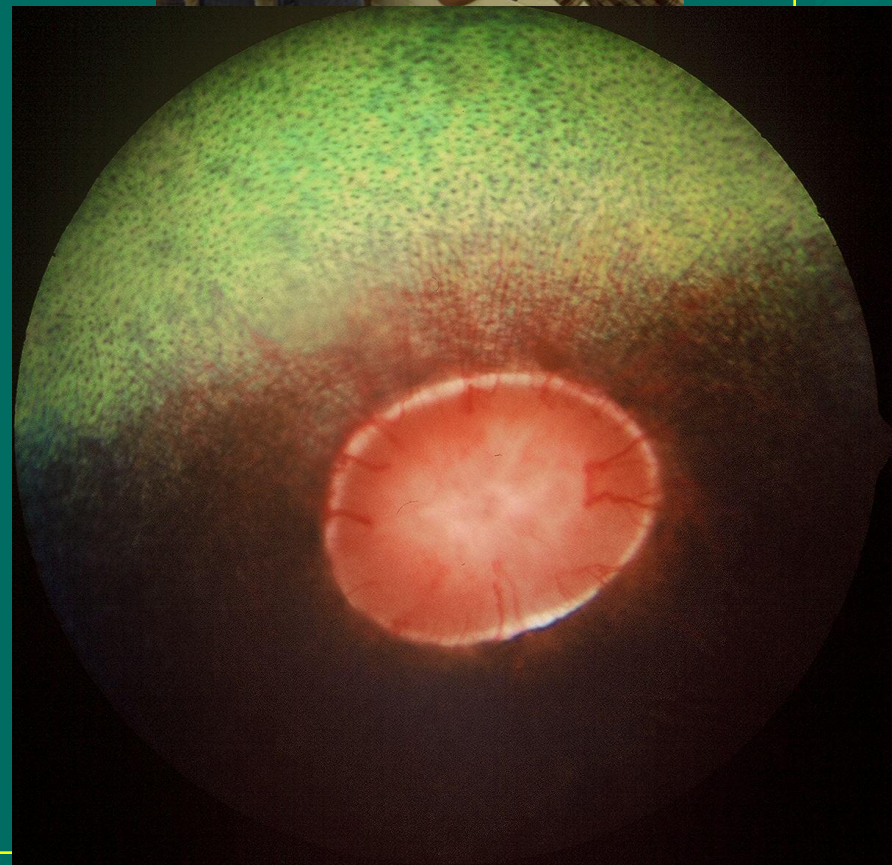
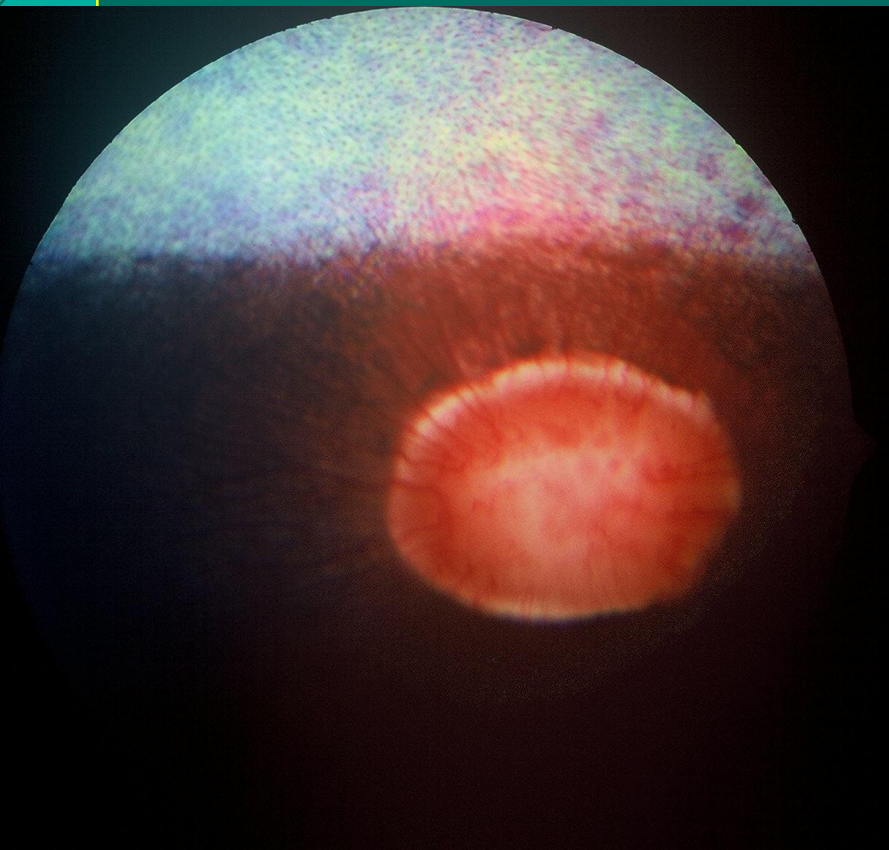
Field of View	
	Standard
	PanOptic
5X Larger Viewing Area	



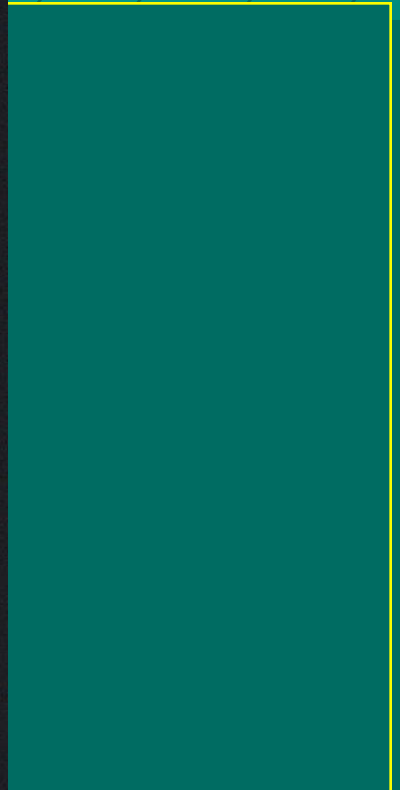
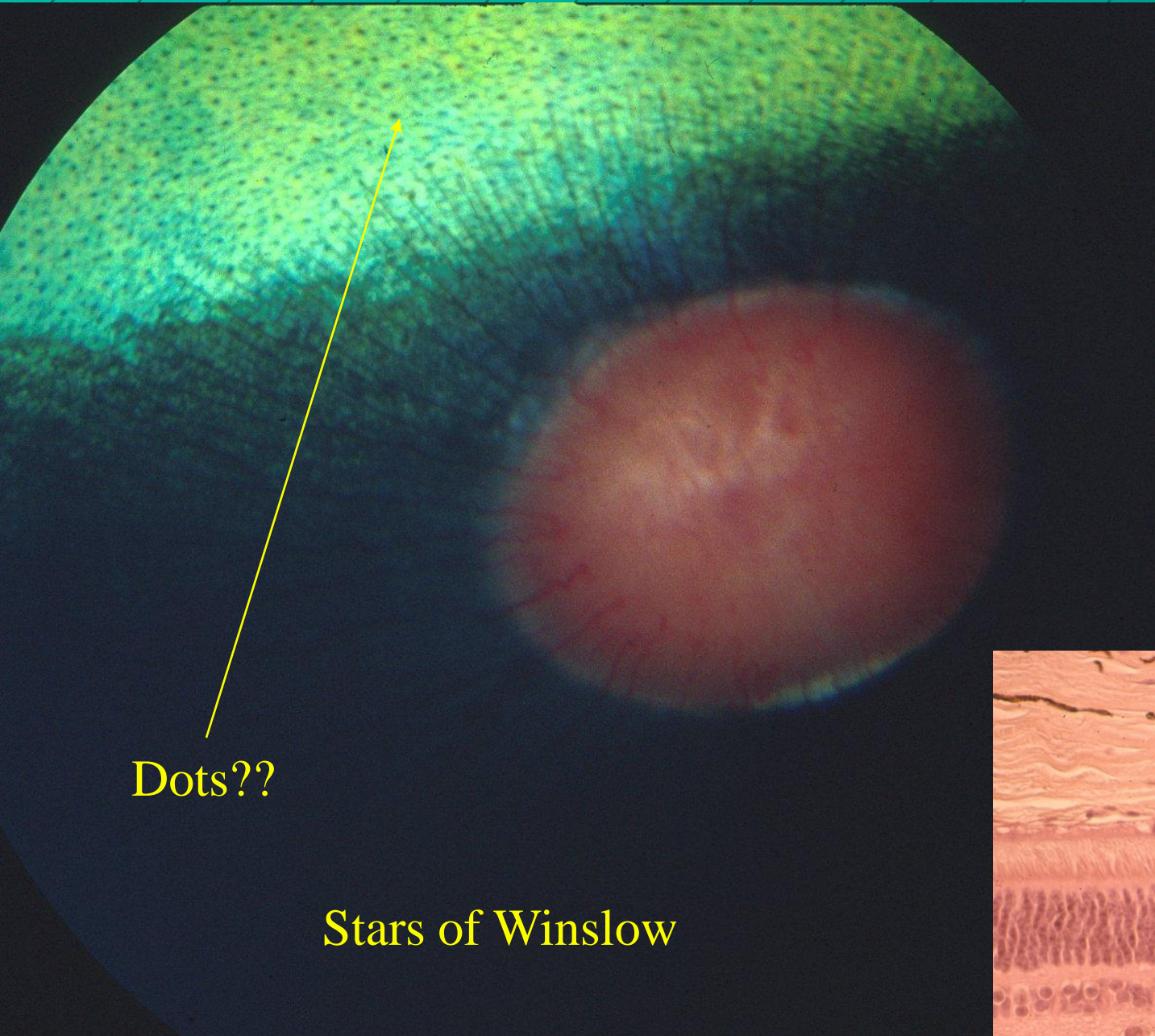
Introducing  
the Welch Allyn®  
PanOptic™  
Ophthalmoscope  
with innovative  
Axial PointSource™  
Optics

Revolutionary  
new technology  
for a difference  
you can see.

CD-ROM for Windows®

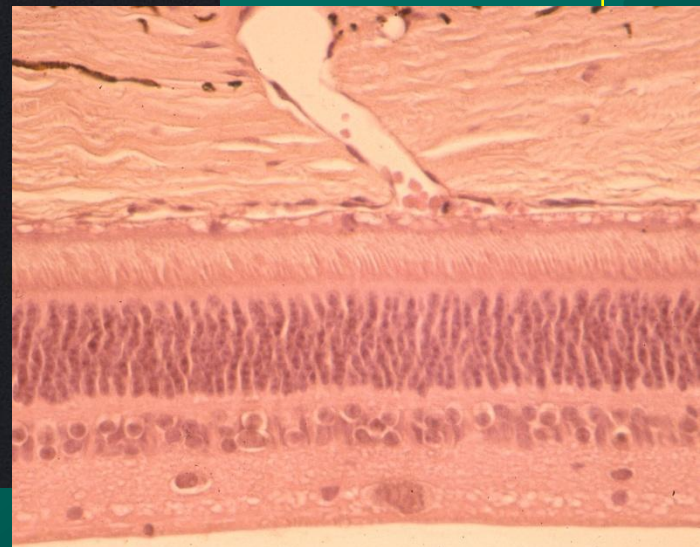






Dots??

Stars of Winslow

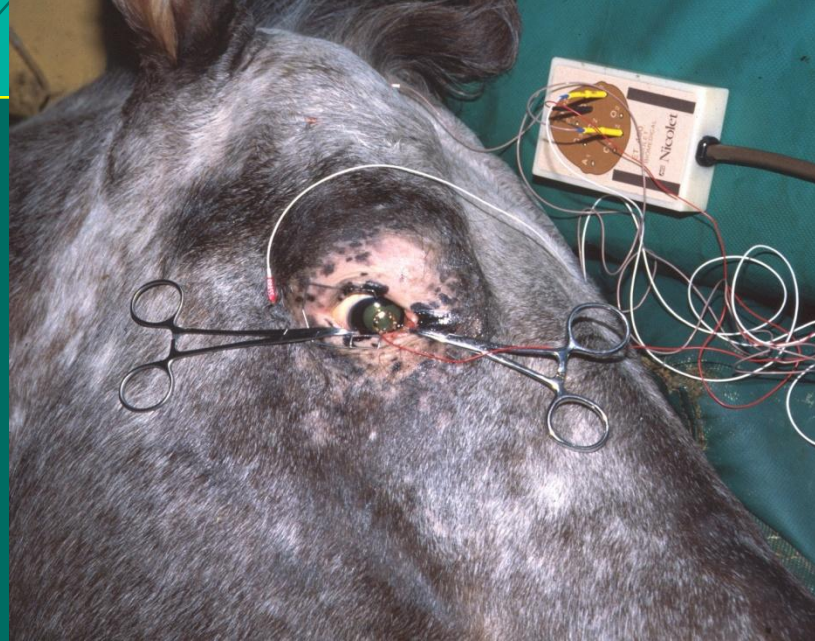


- Visual impairment in dim light with generally normal vision in daylight
- Behavioral uneasiness at night
- Normal retinal appearance!!
- Defect in neural transmission related to reduced expression of the *TRPM1* gene.
  - (Transient Receptor Potential Melatansin1)

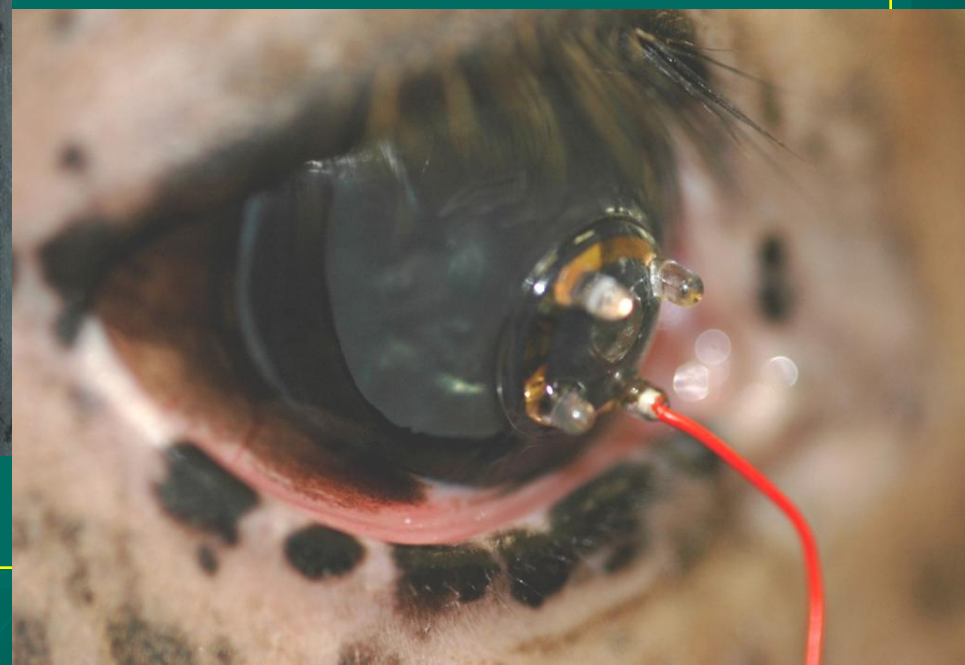
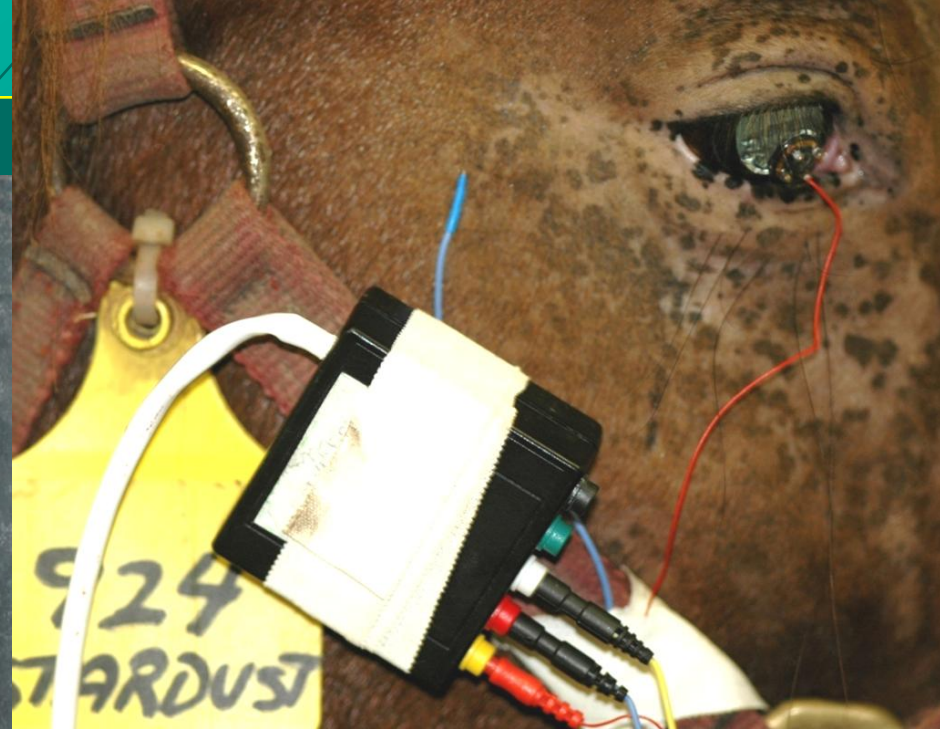




# CSNB

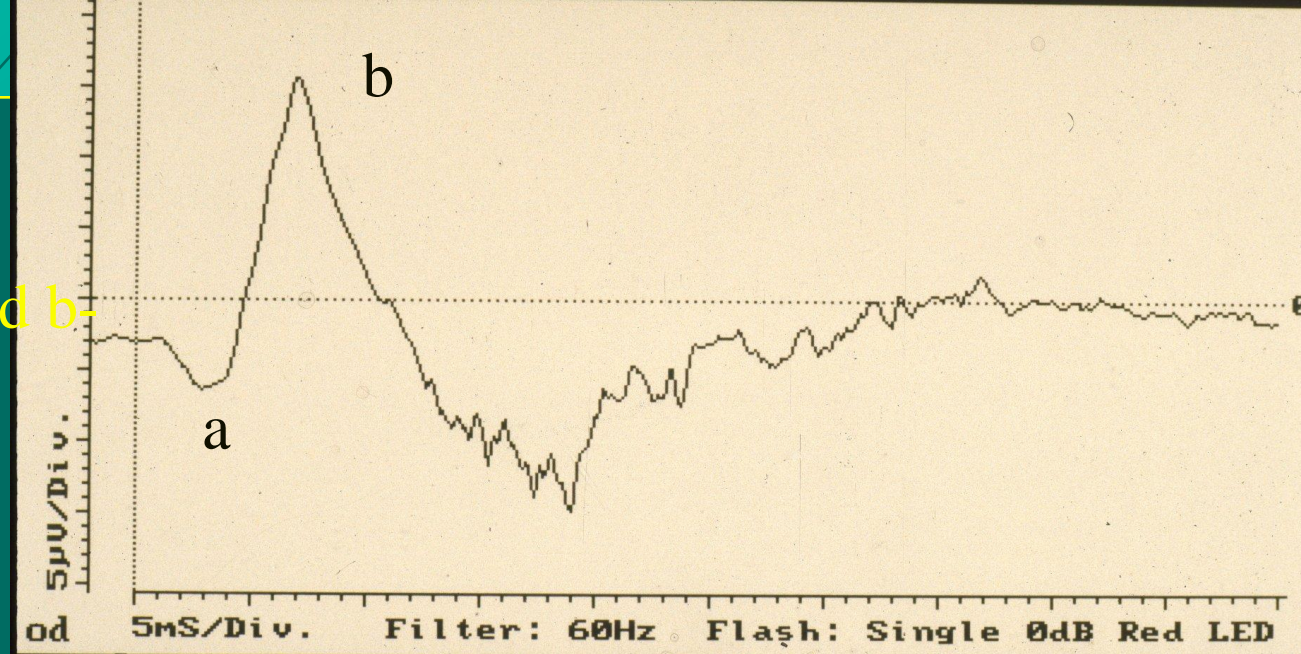


- ERG: large negative scotopic a-wave with decreased scotopic b-wave amplitude
- Normal histology suggesting a neurotransmission problem in the middle retina
- The true incidence of this disease in Appaloosas is not known but may approach 25%
- No treatment
- Do not breed

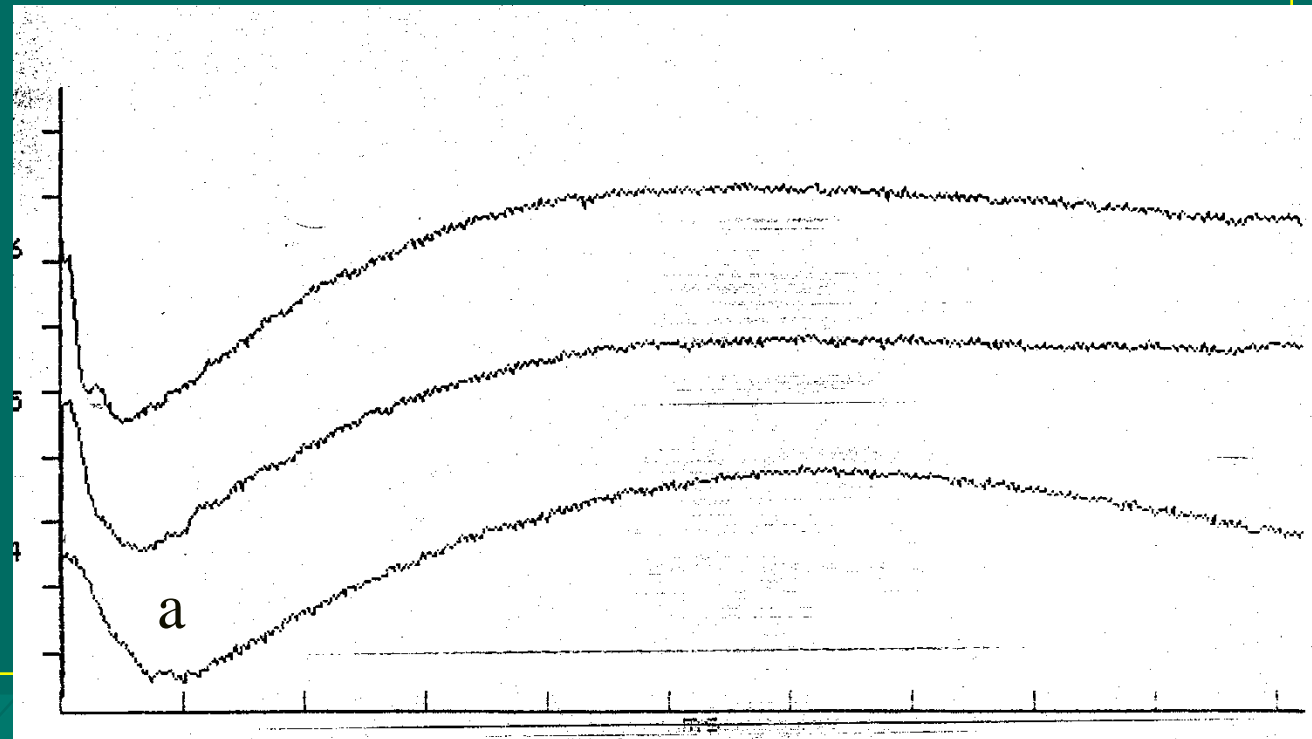




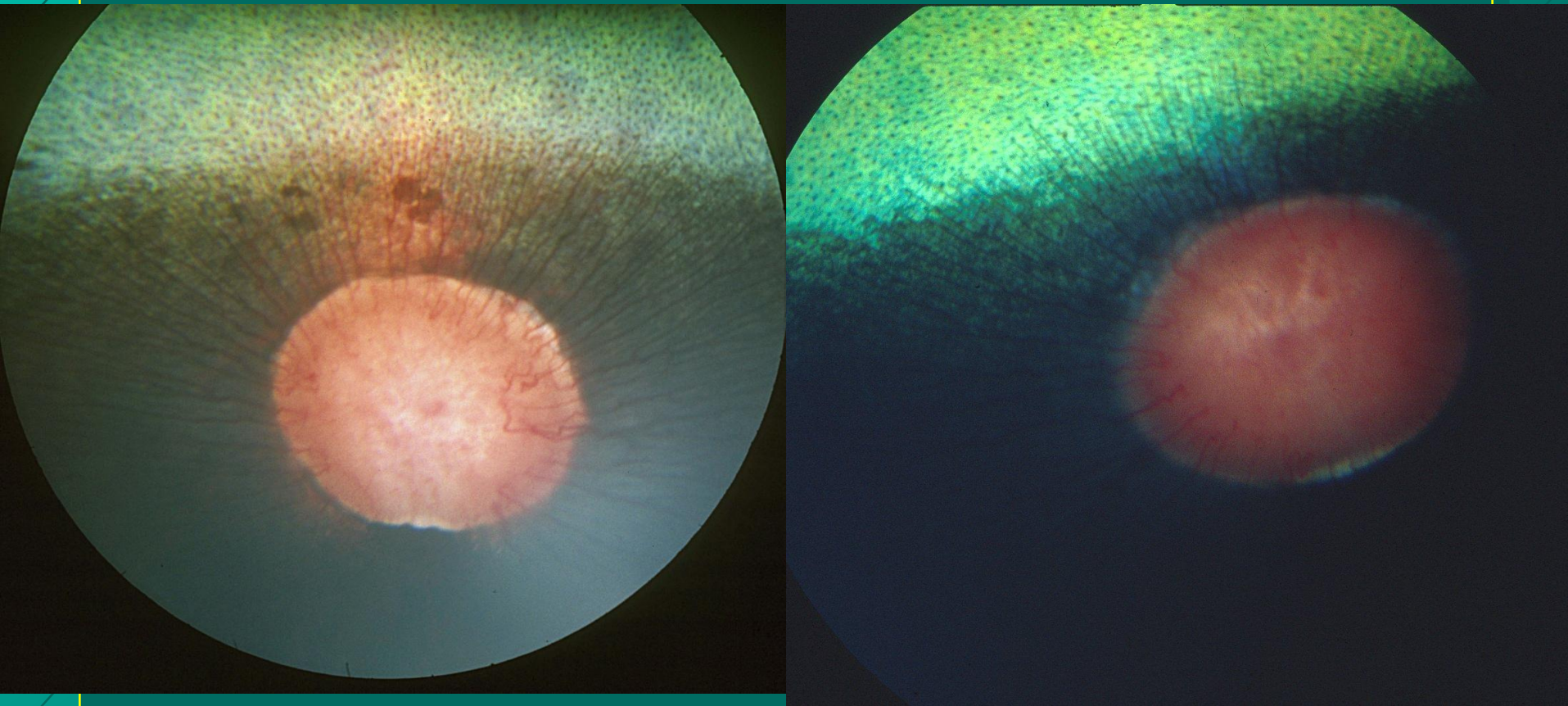
Normal ERG a- and b-waves



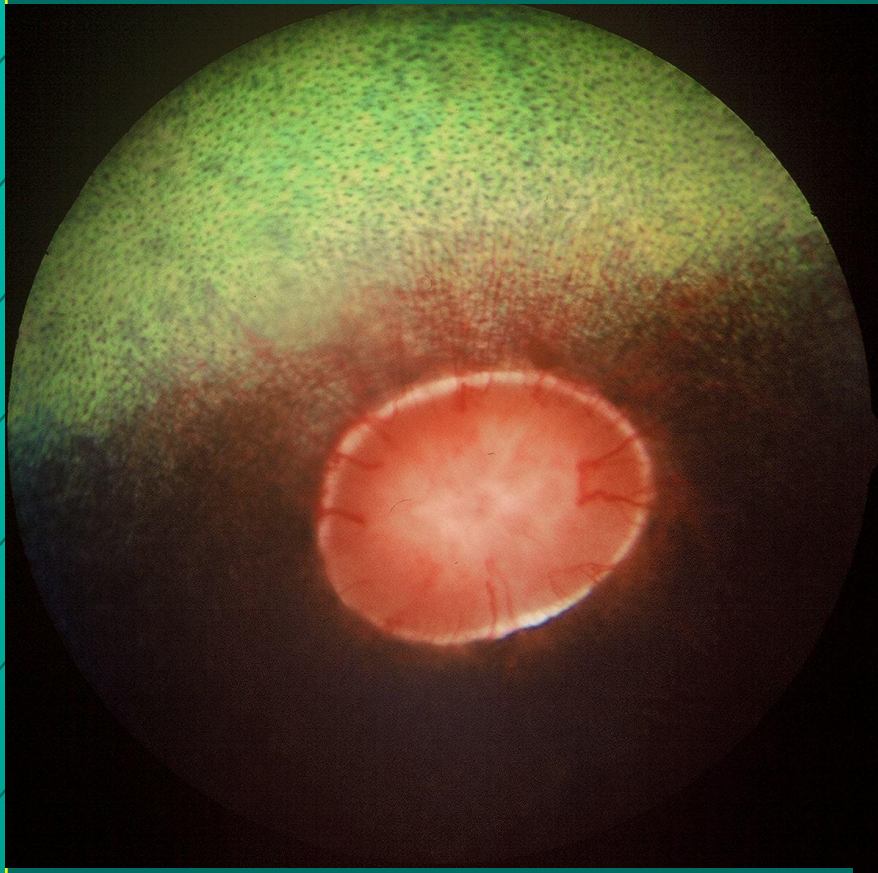
CSNB:  
all a-wave



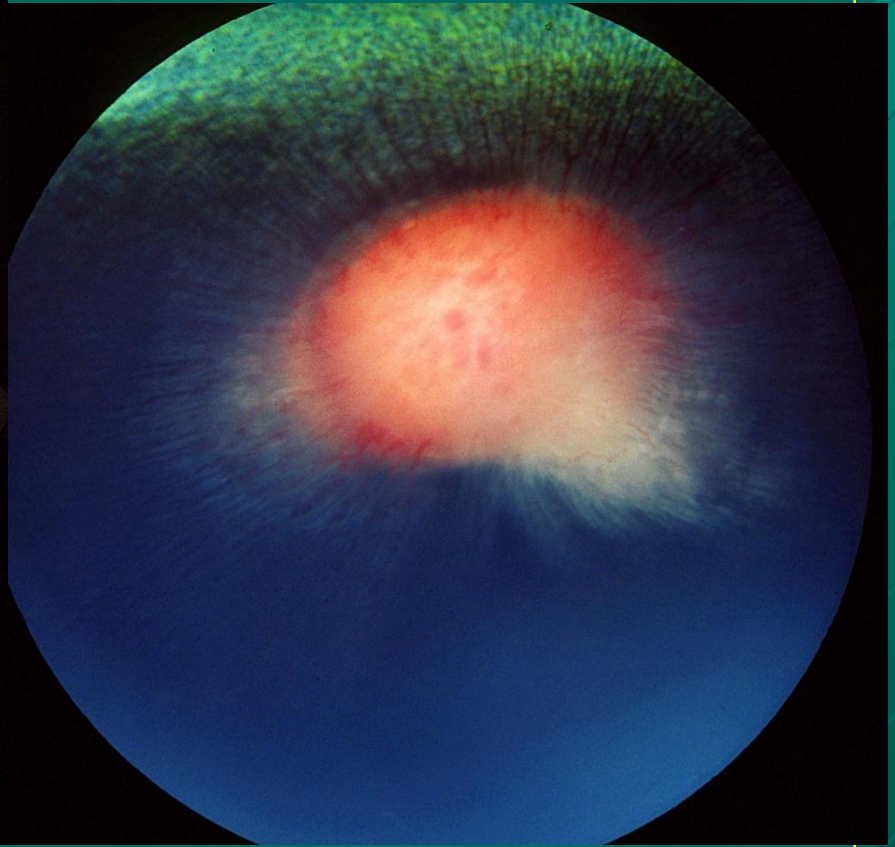
# Retinal images





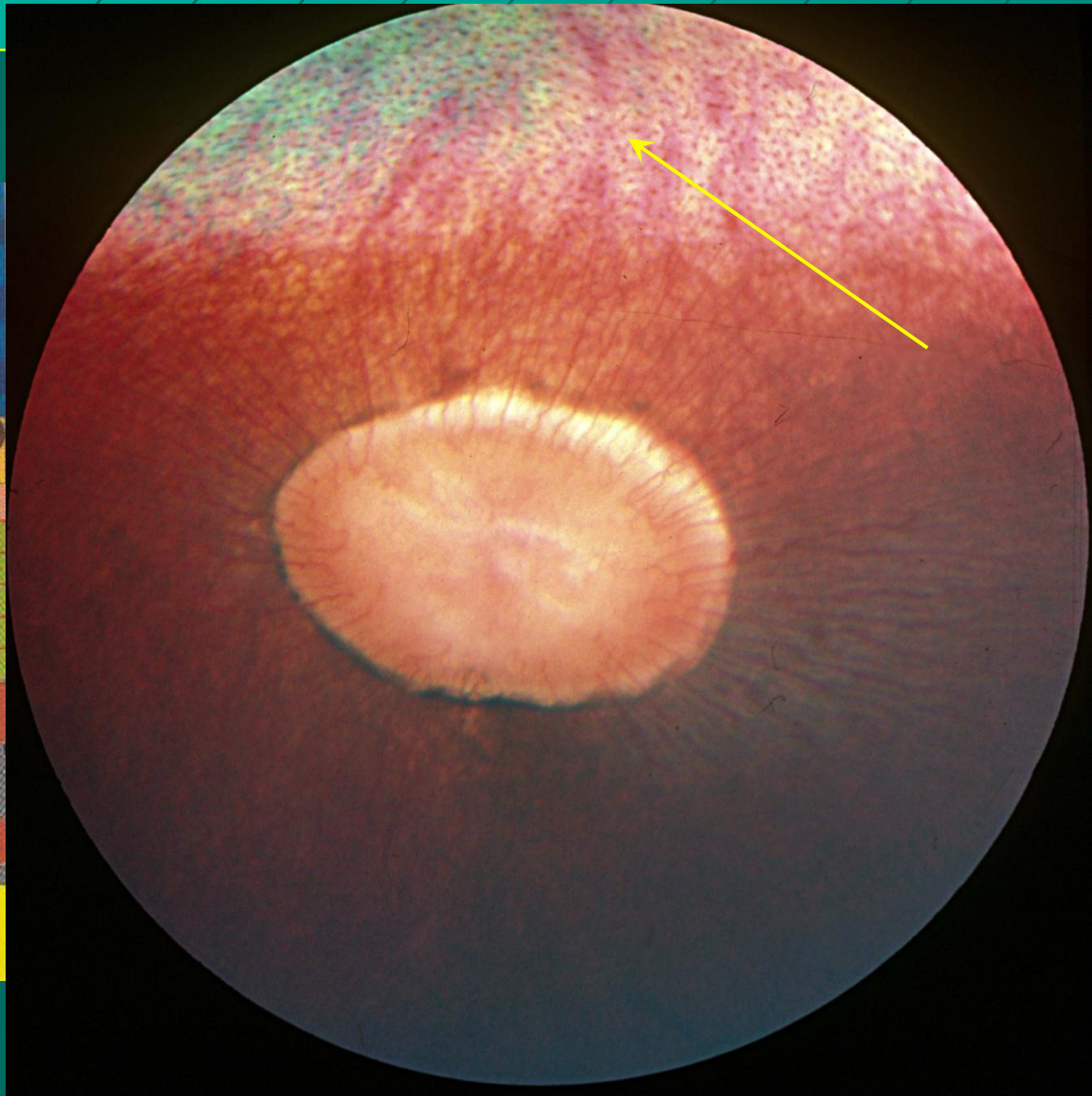
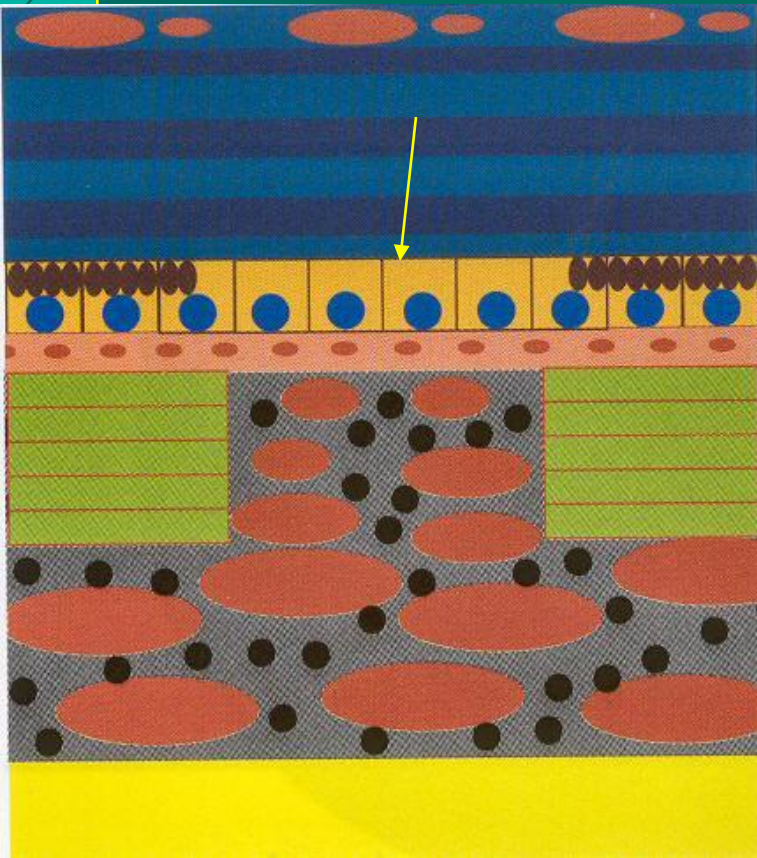


Normal



Excess myelin (AM)

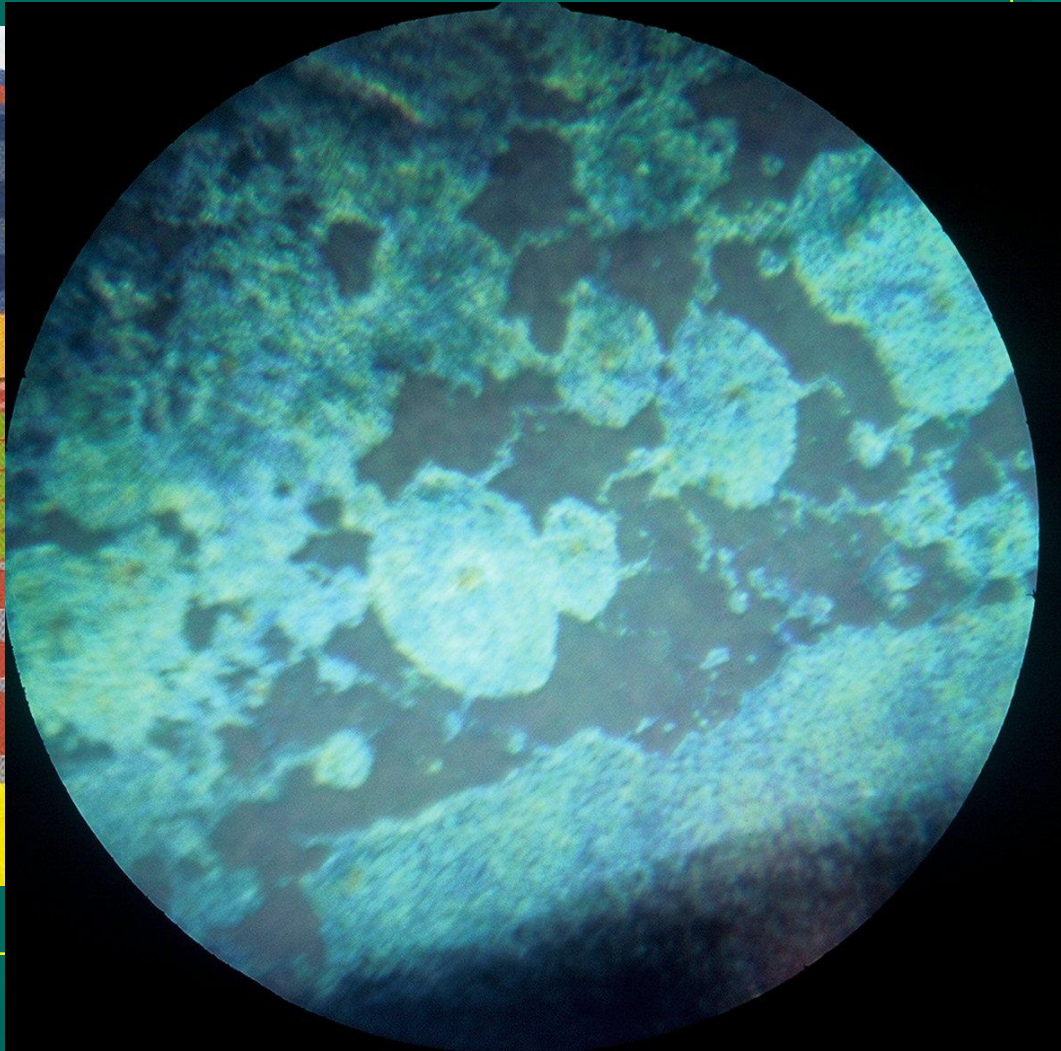
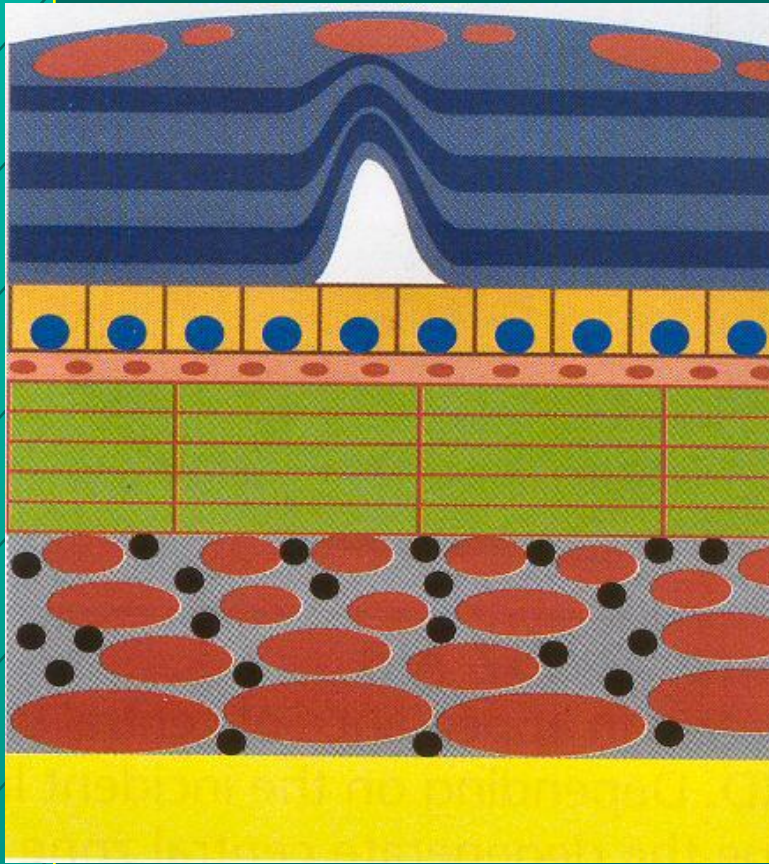




Tapetal thinning

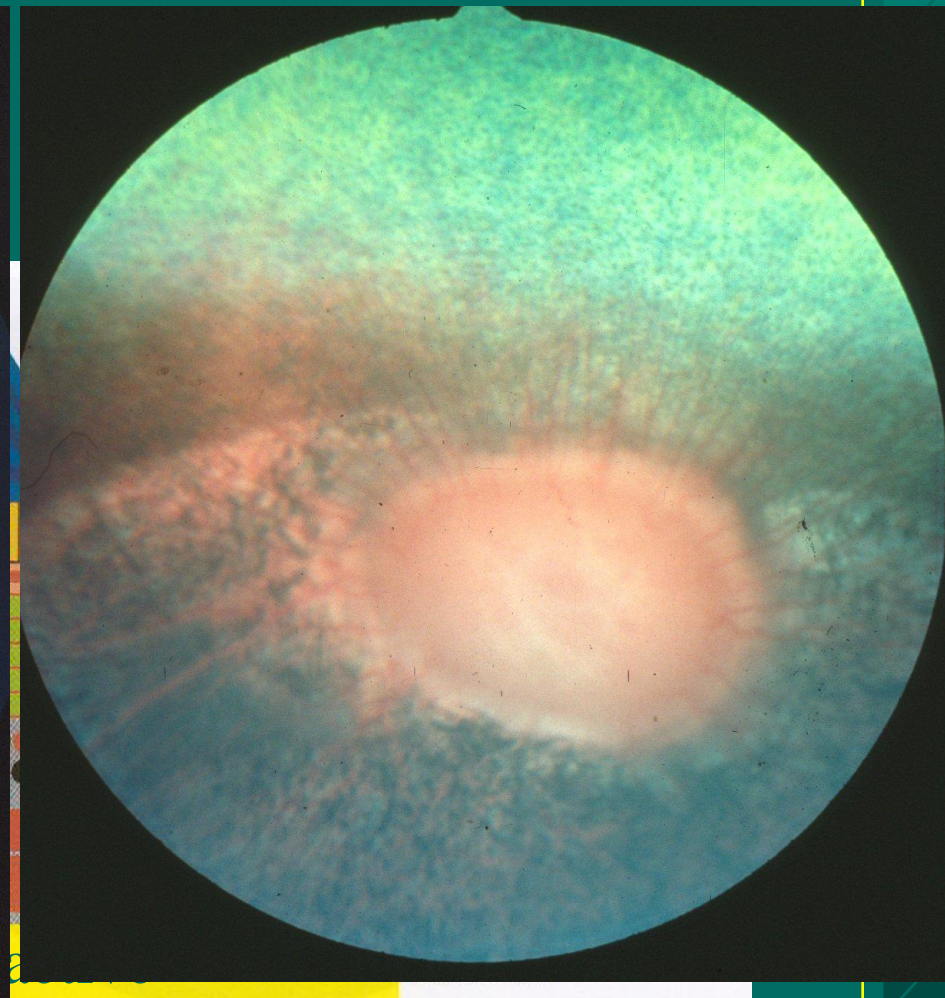
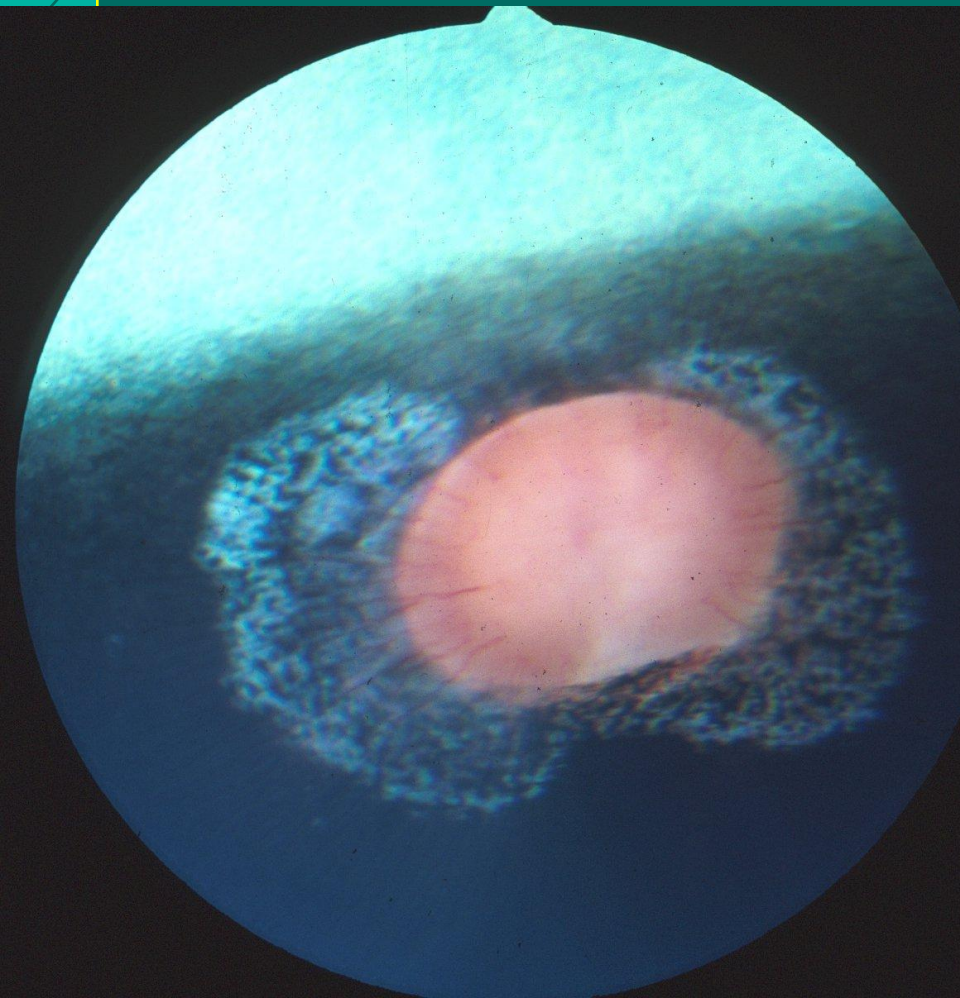


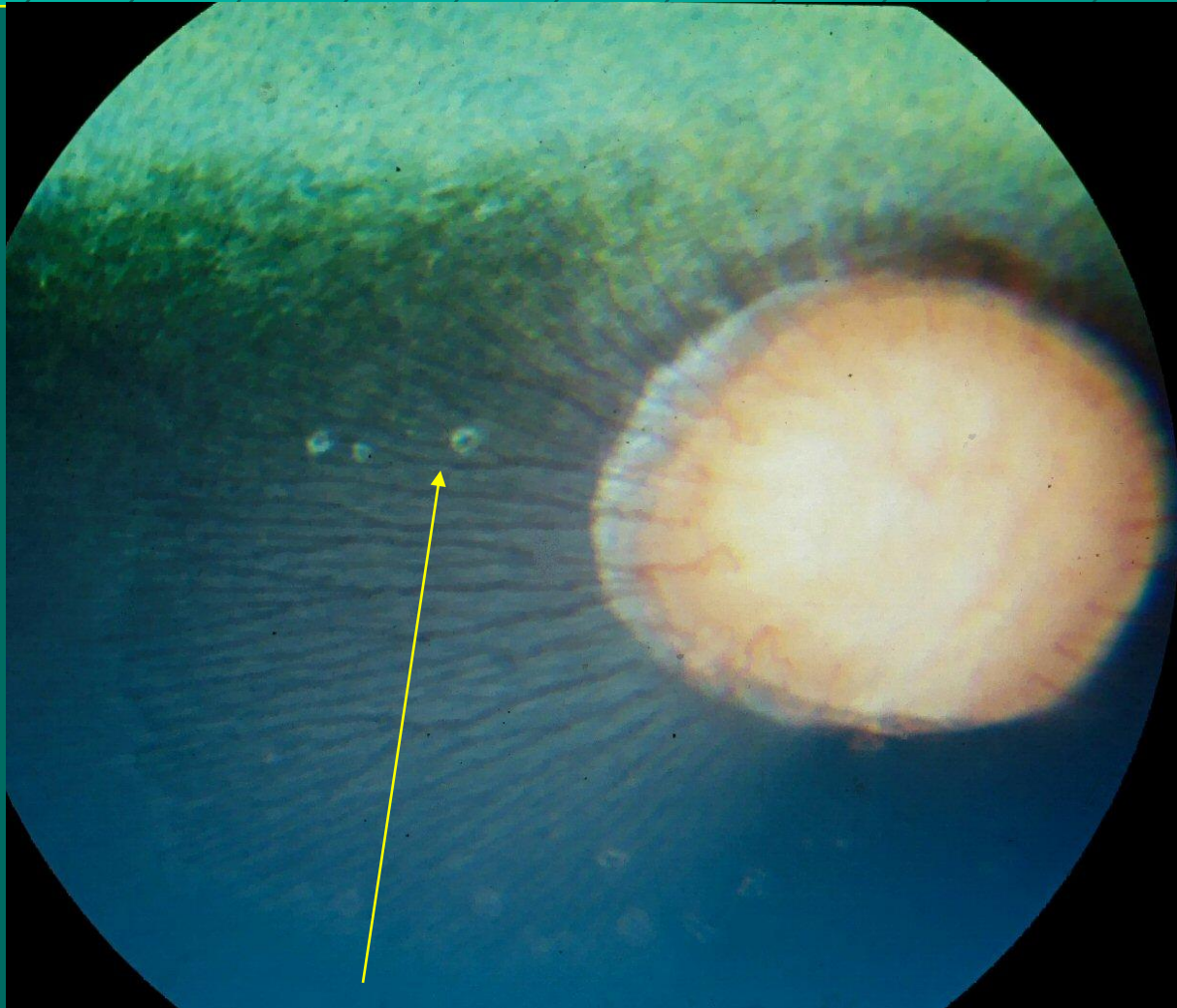
# Retinal Dysplasia





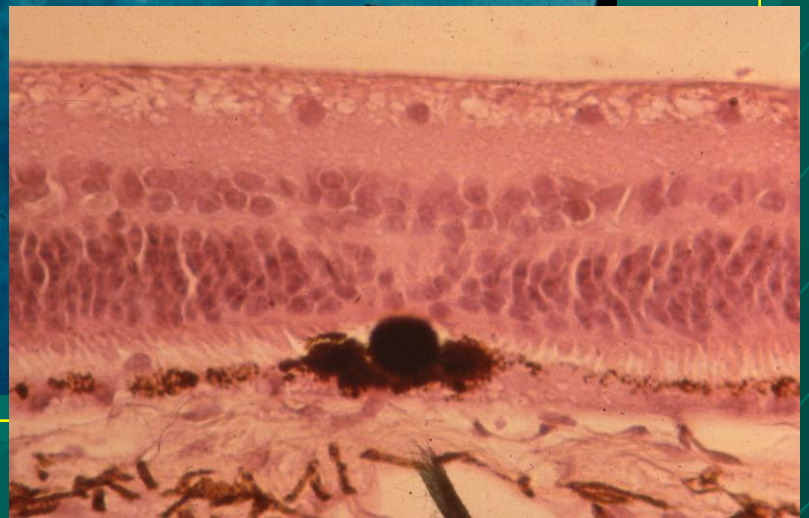
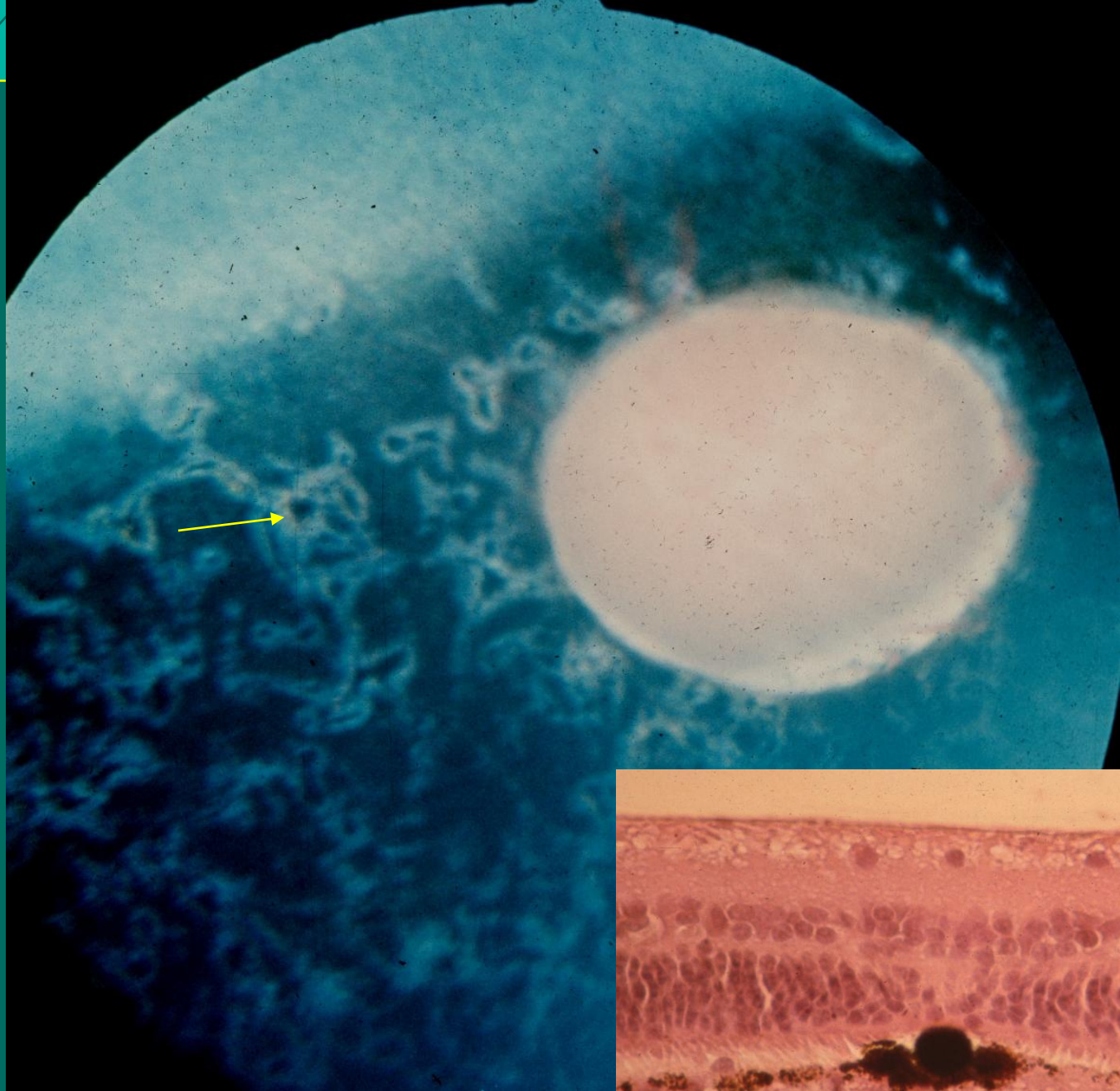
# Chorioretinitis





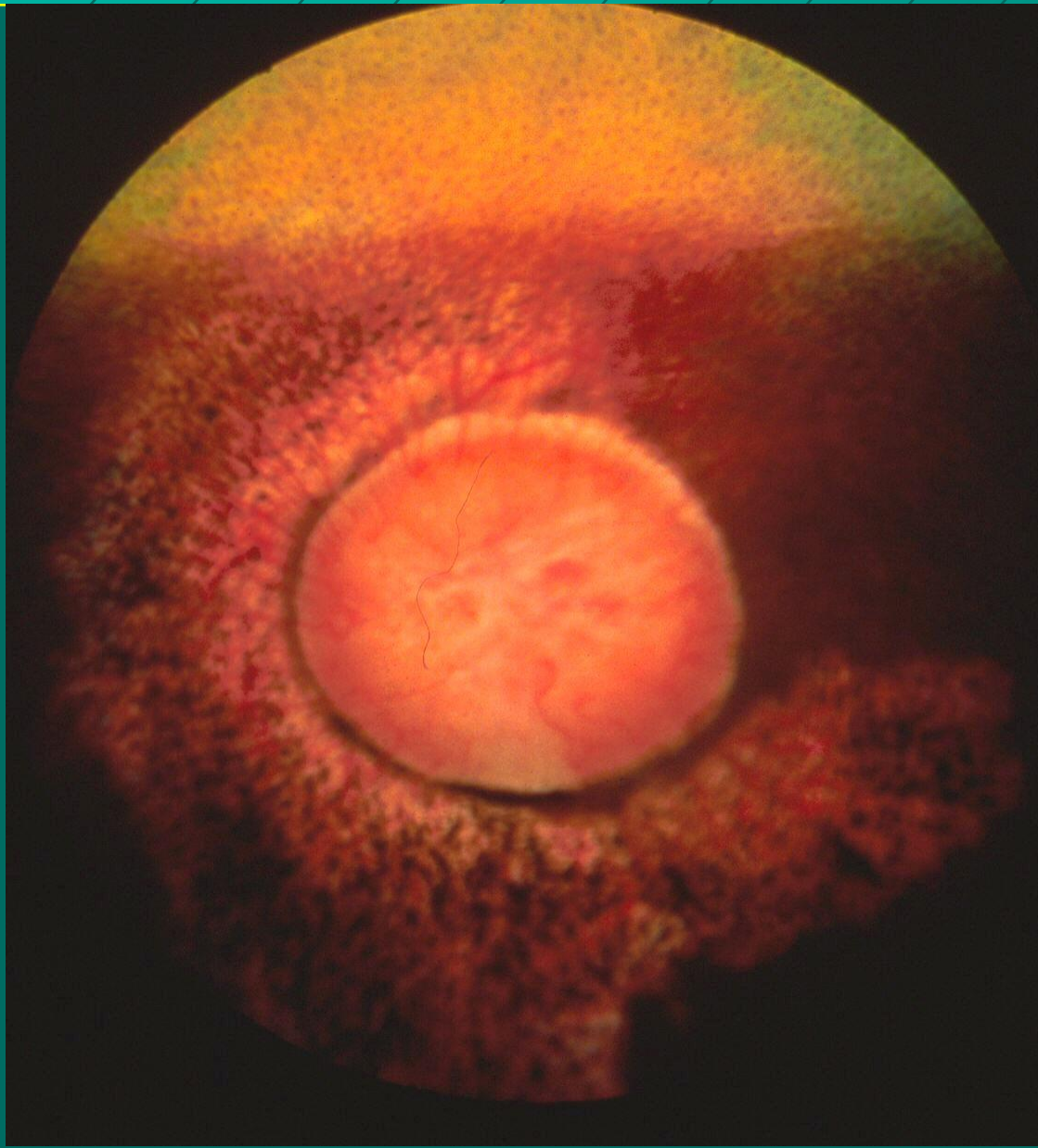
“bullet hole” chorioretinitis: not related to ERU

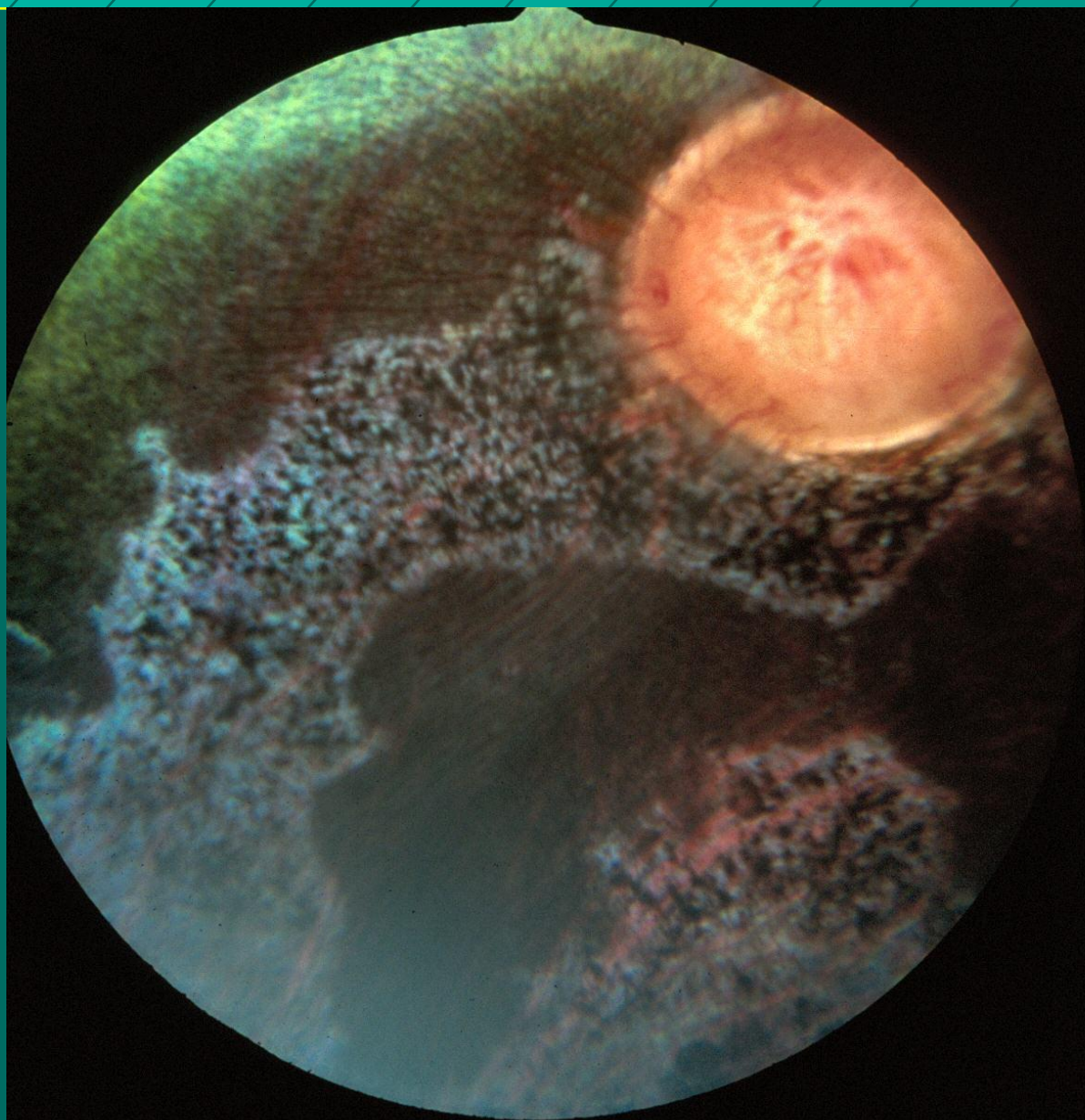






ERU

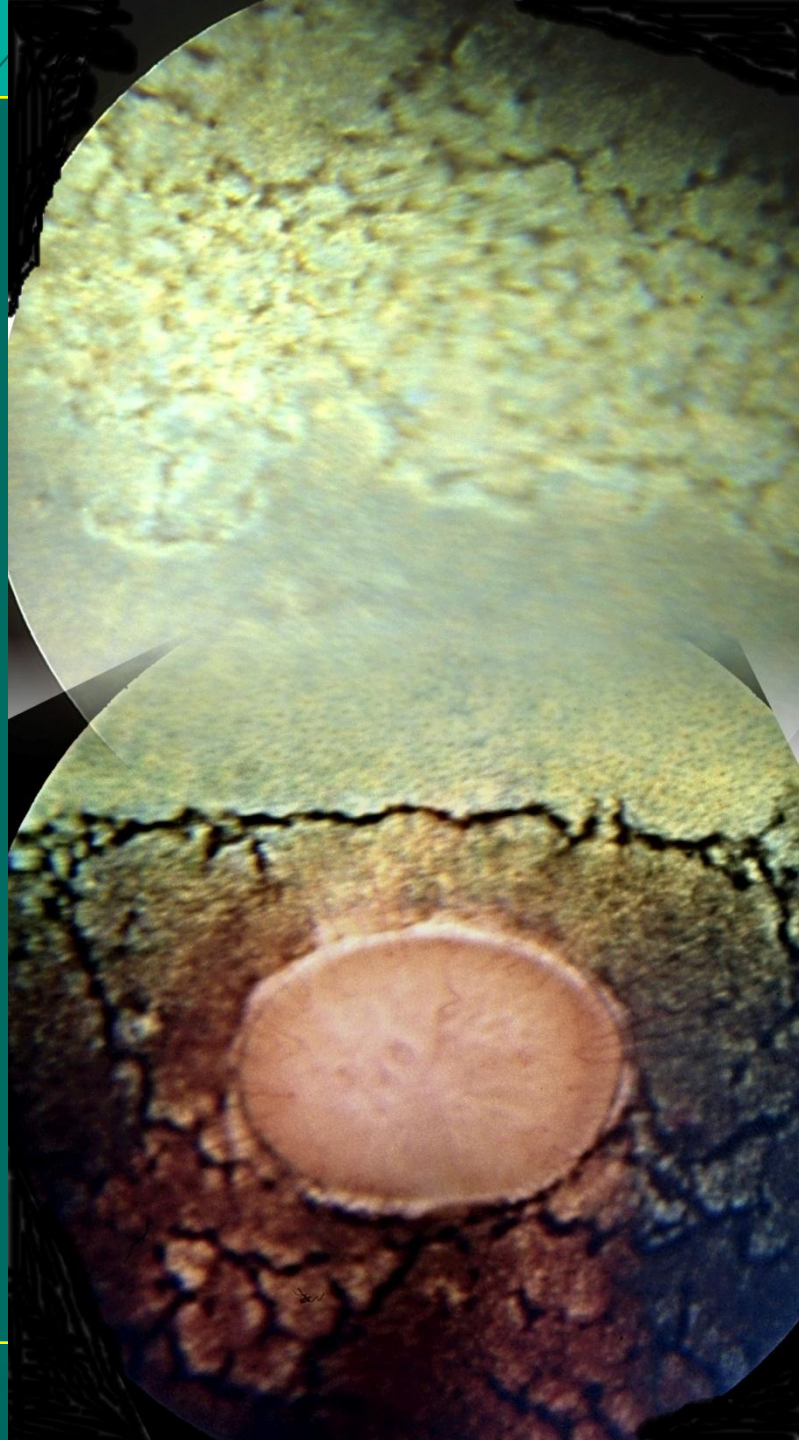




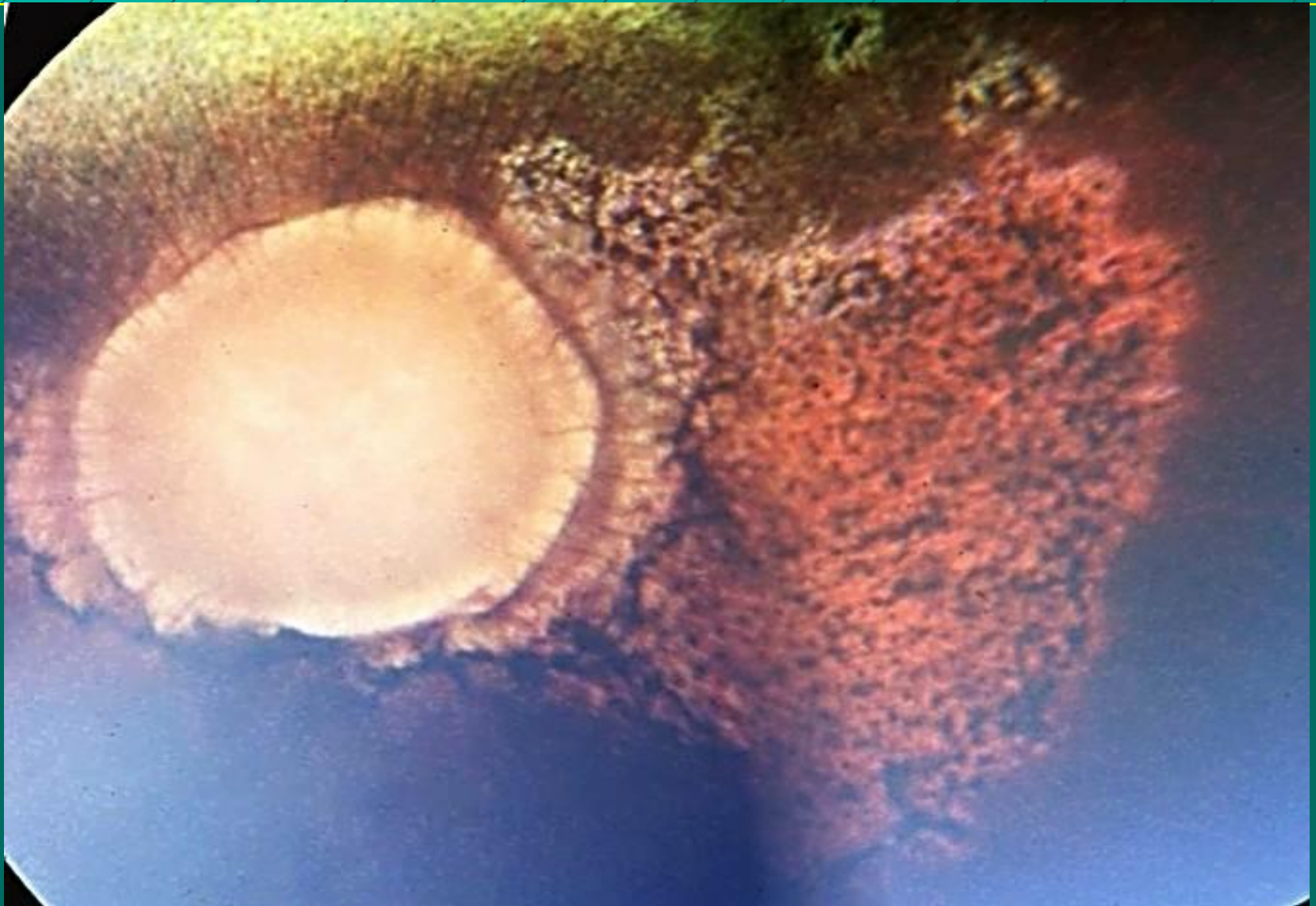
ERU



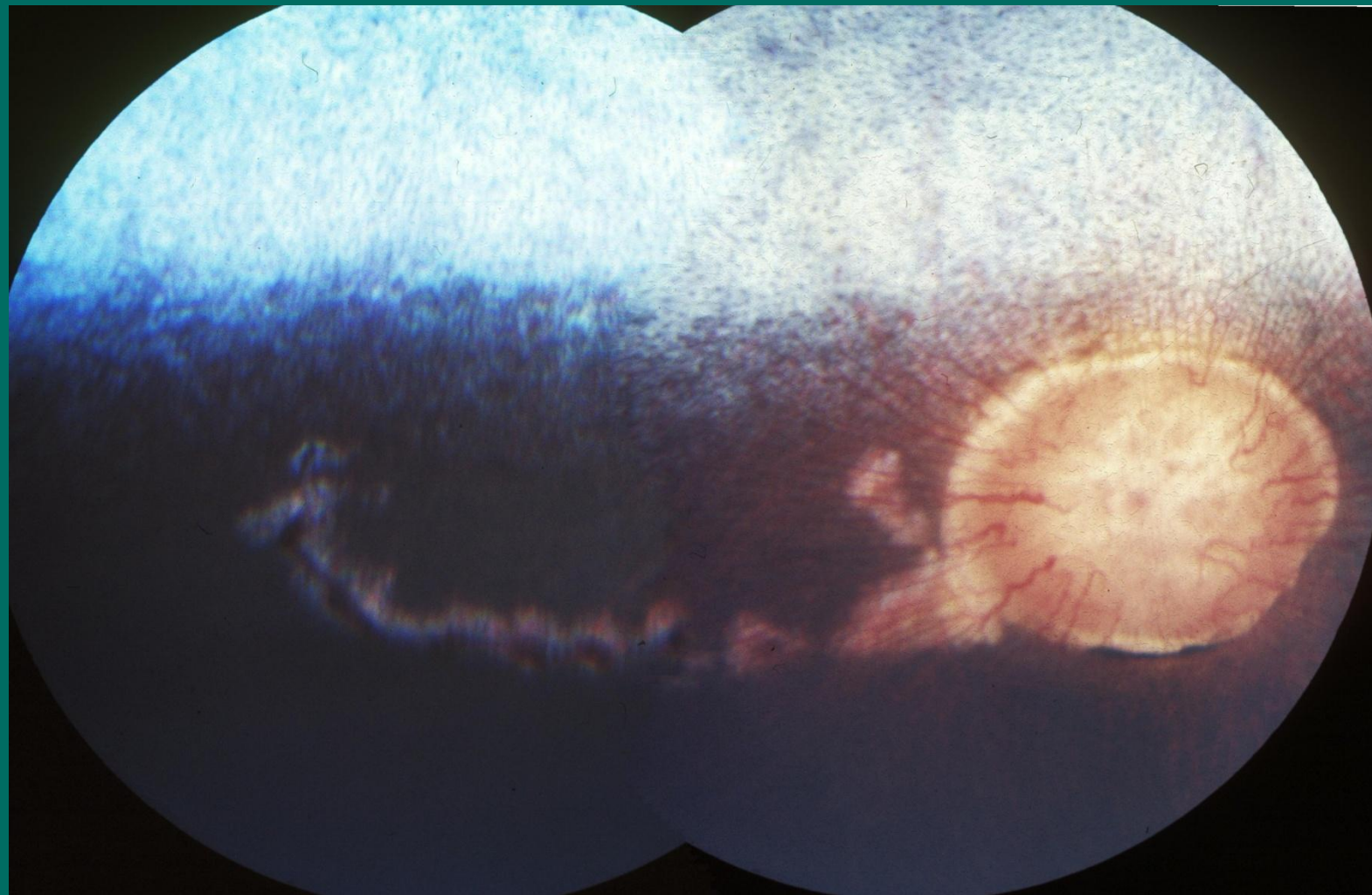
- Matthews Scotland







■ Matthews Scotland



Chorioretinitis in Scotland (Matthews)

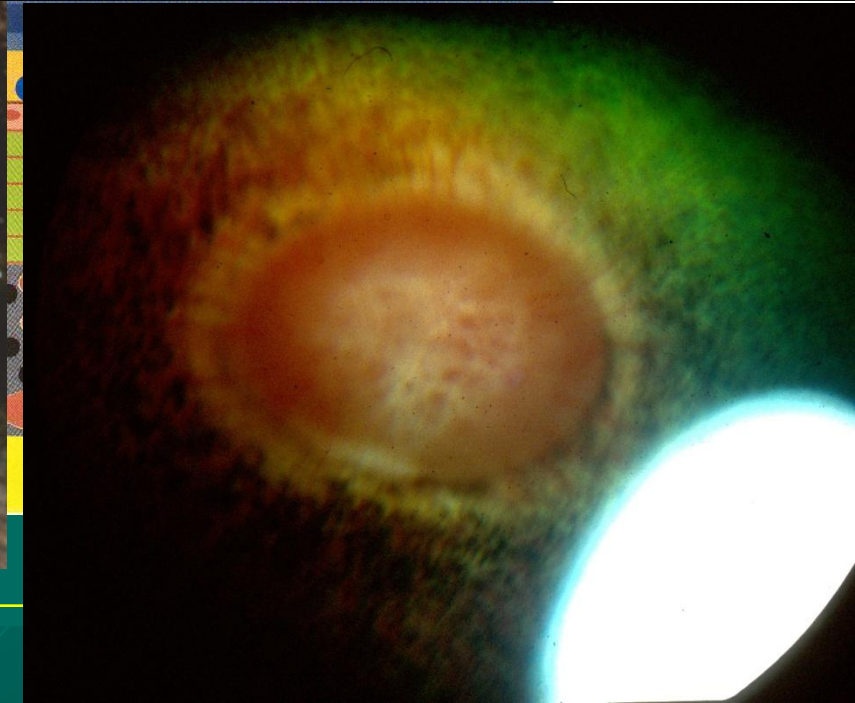
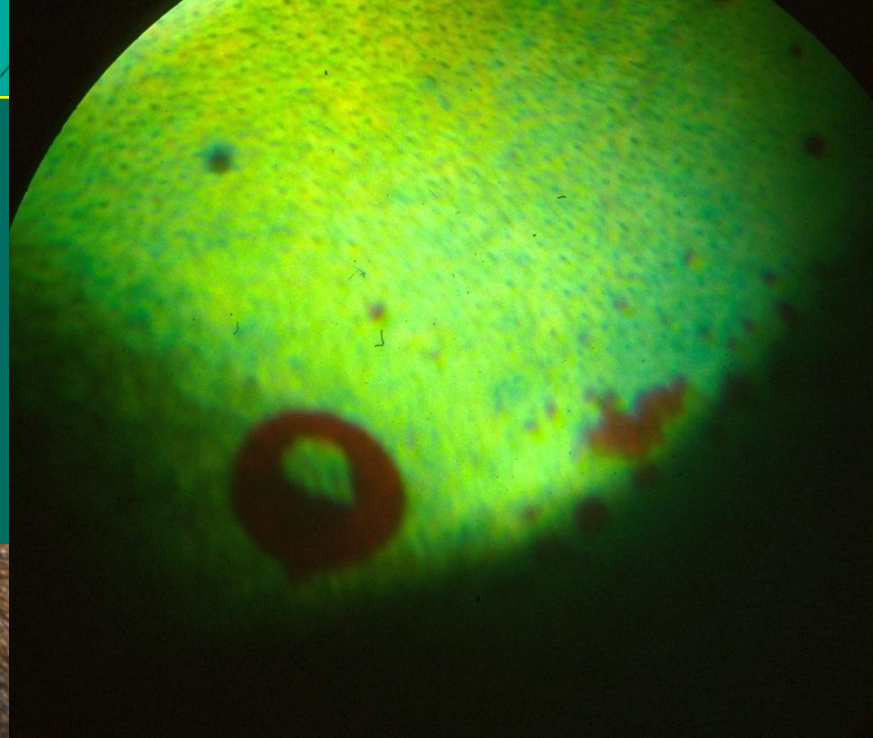




Italy: blindness  
Horizontal band of depigmentation

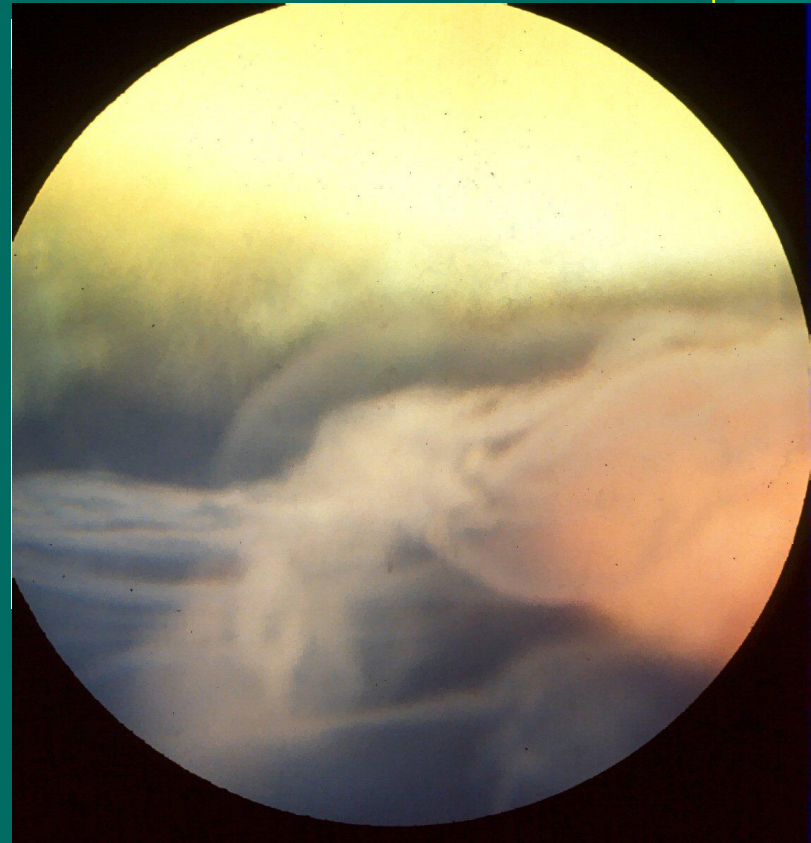


Hyphema and retinal hemorrhages.  
Found in foals in many eyes.

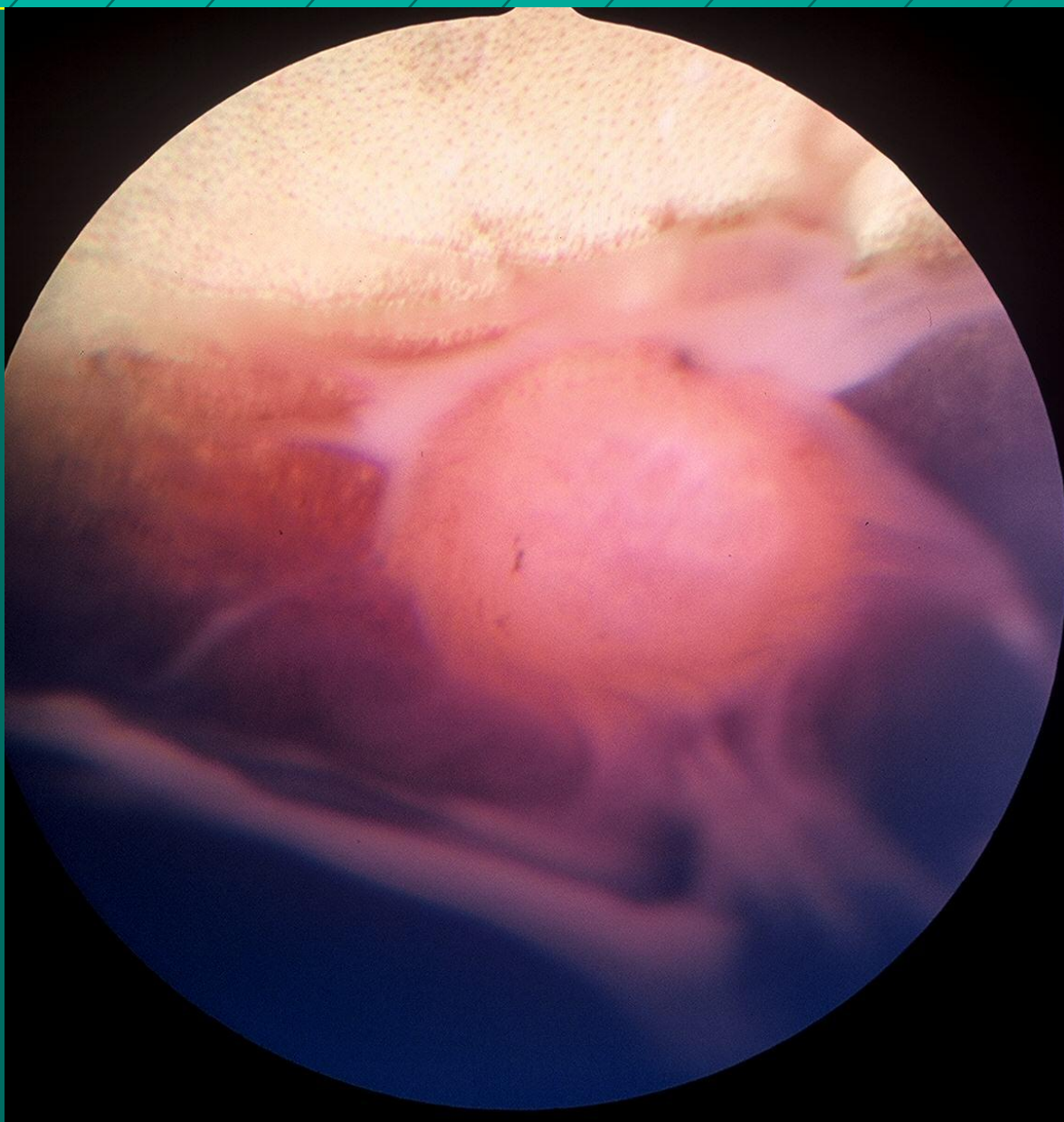


# Retinal Detachments

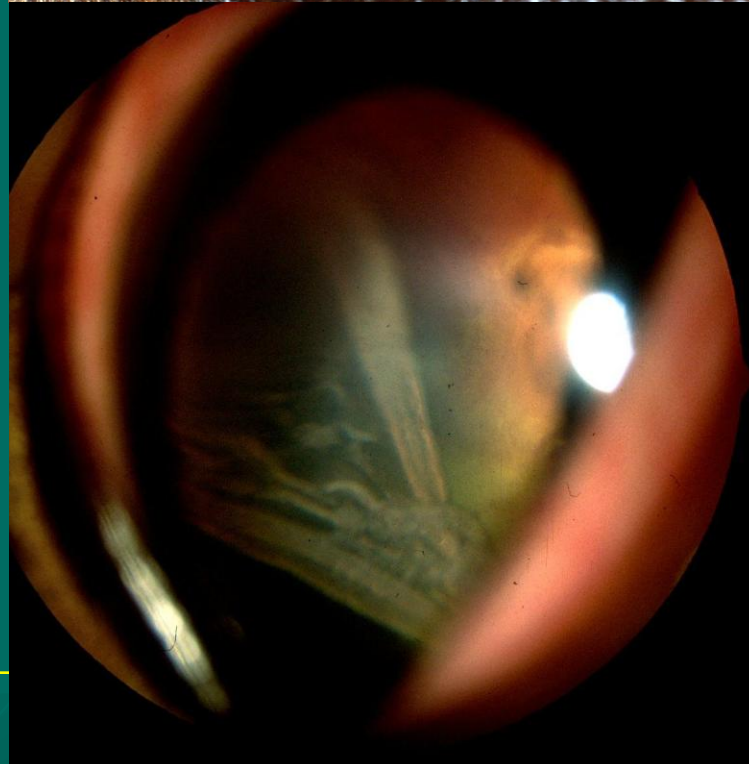
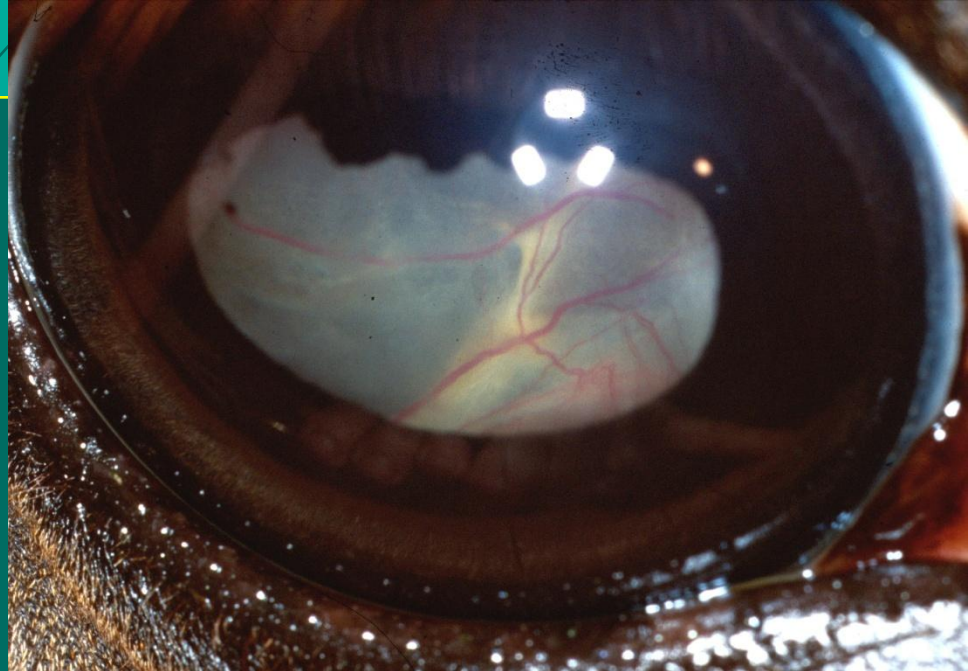
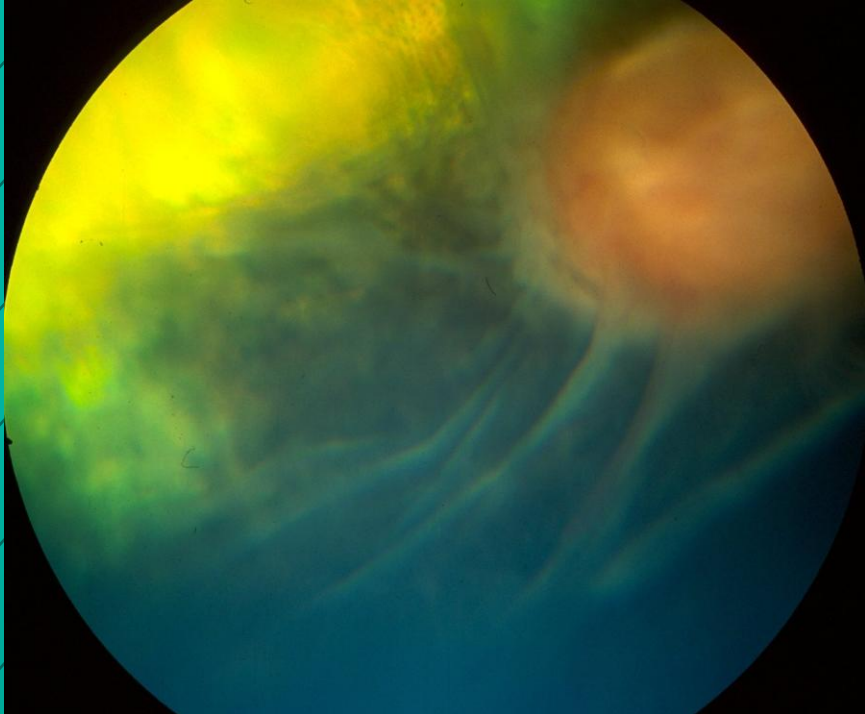
- Exudative and traction RD are found in the horse.
- Total RD: free-floating, opaque veils overlying the optic disc.
  - Tapetal hyperreflectivity
- Primary in RMH.
- Secondary to ERU, head trauma, perforating globe wounds, and tumors
- No treatment

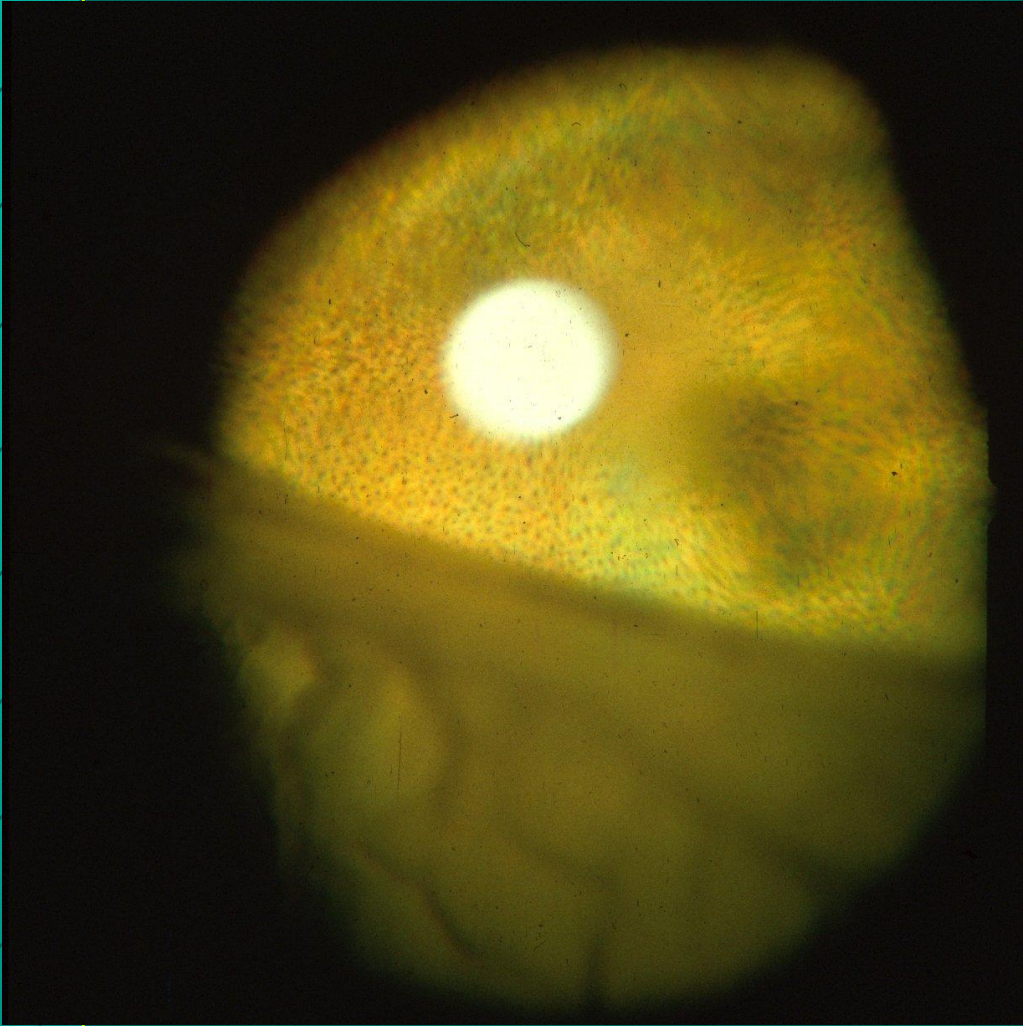






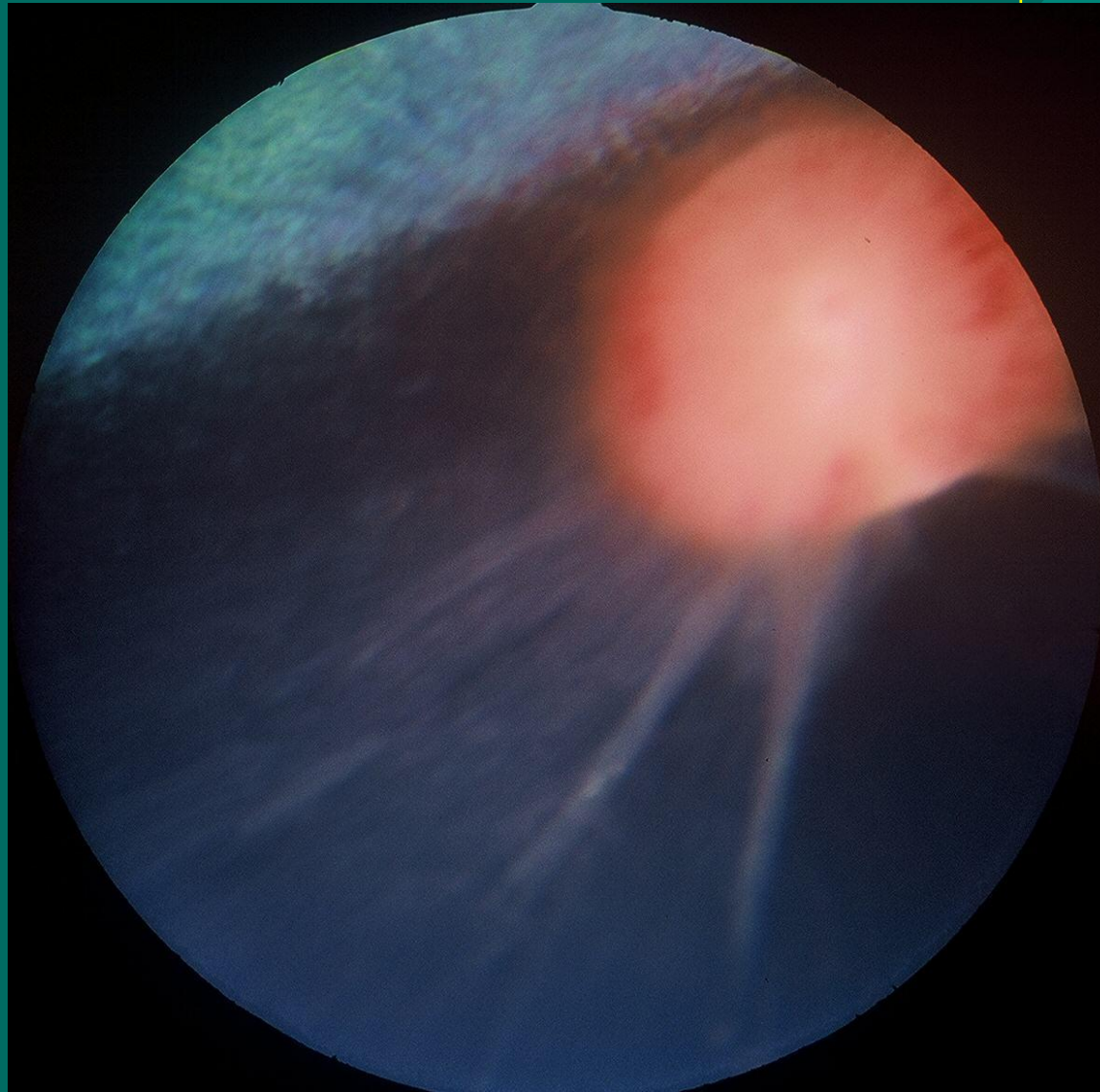








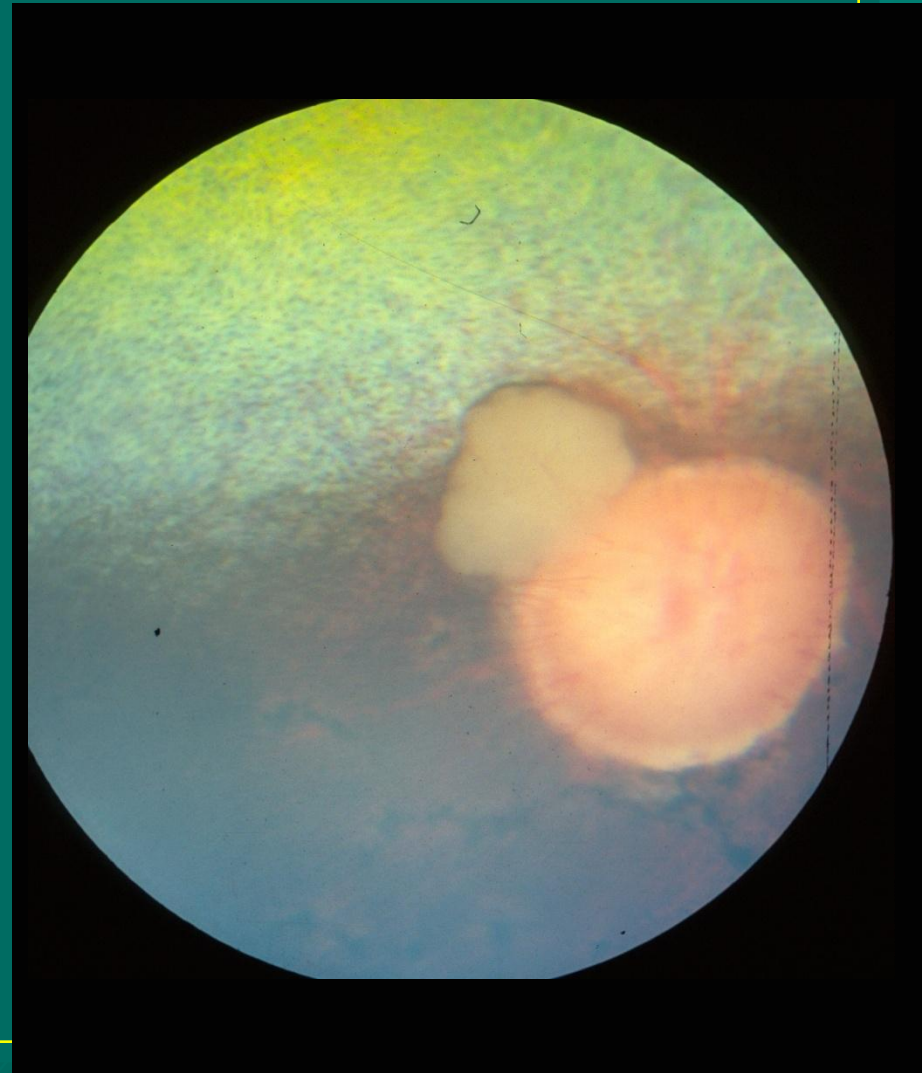
- Some exudative RD can reattach and leave retinal folds





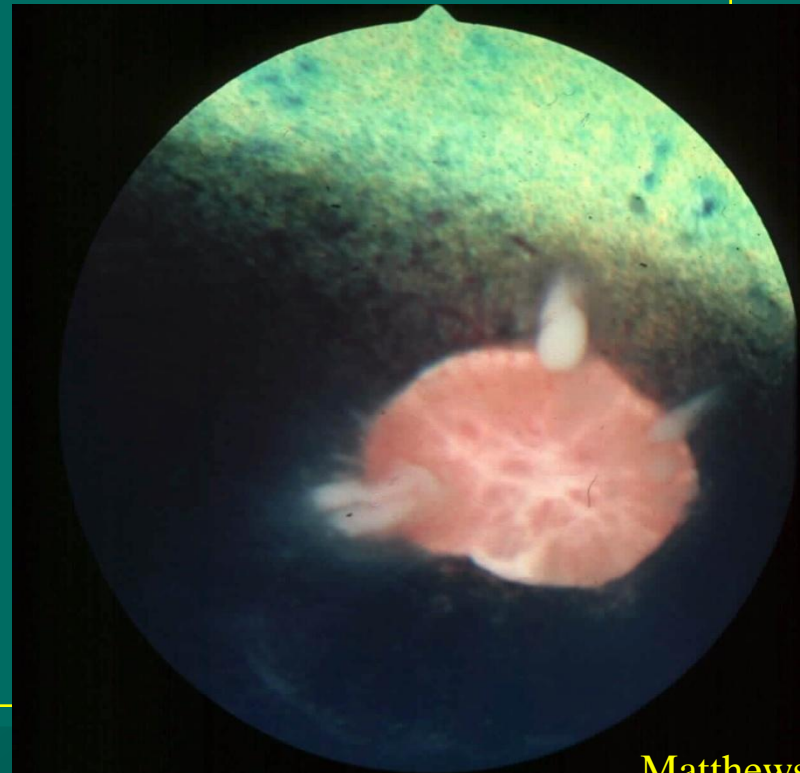
# Proliferative Optic Neuropathy

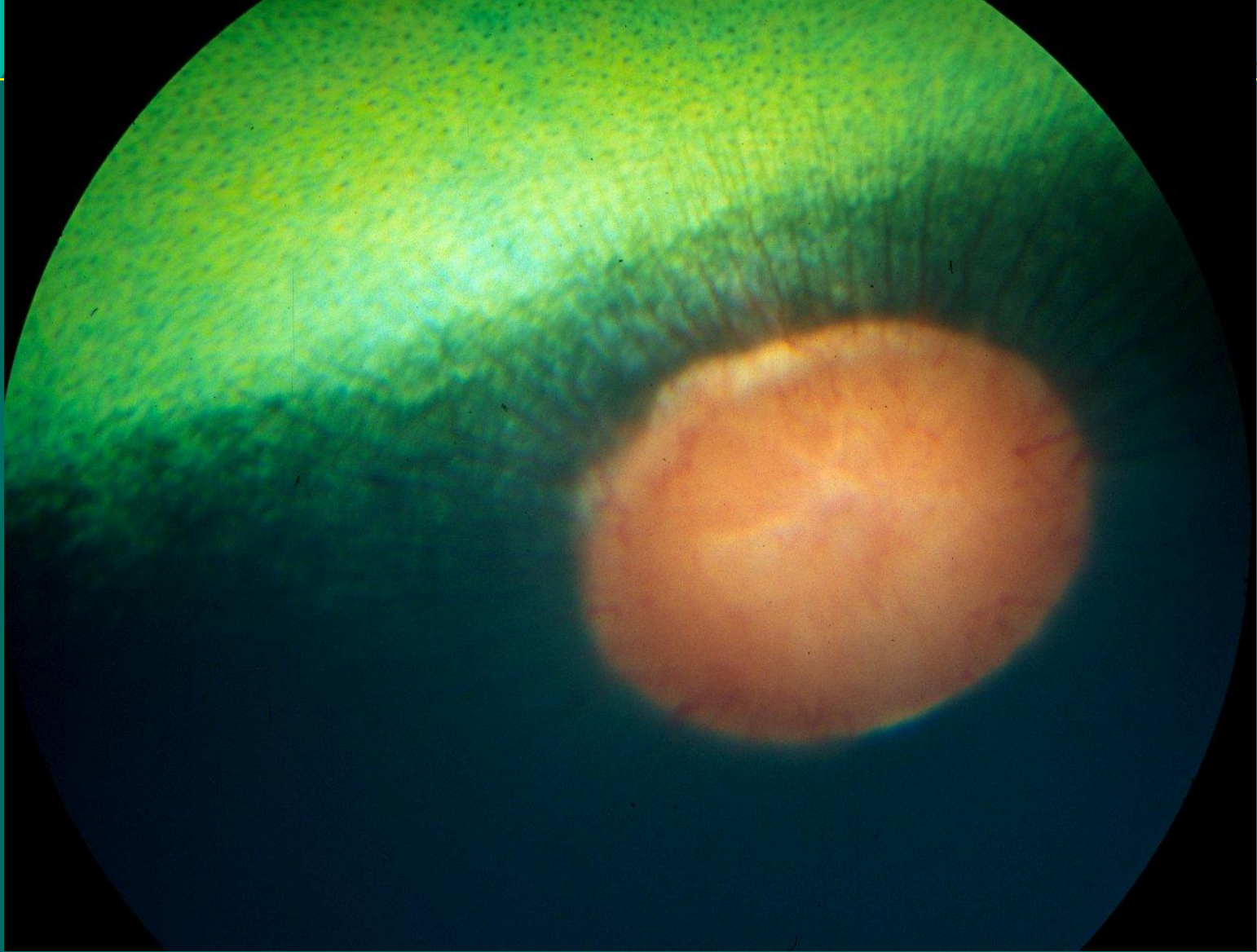
- PON is in older horses
- a slowly enlarging white mass protruding from the optic disc into the vitreous
- incidental, no effect on vision
- histology: “schwannoma”
- Protrusion of axonal contents
- no therapy.



# Ischemic Optic Neuropathy

- ION is due to ligation of the internal carotid, external carotid and greater palatine arteries for treatment of epistaxis caused by guttural pouch mycosis.
  - Maxillary artery only should be occluded
- Can result in sudden, irreversible blindness to the eye on the surgically operated side.
- Optic disc congestion and NFL involvement are prominent.

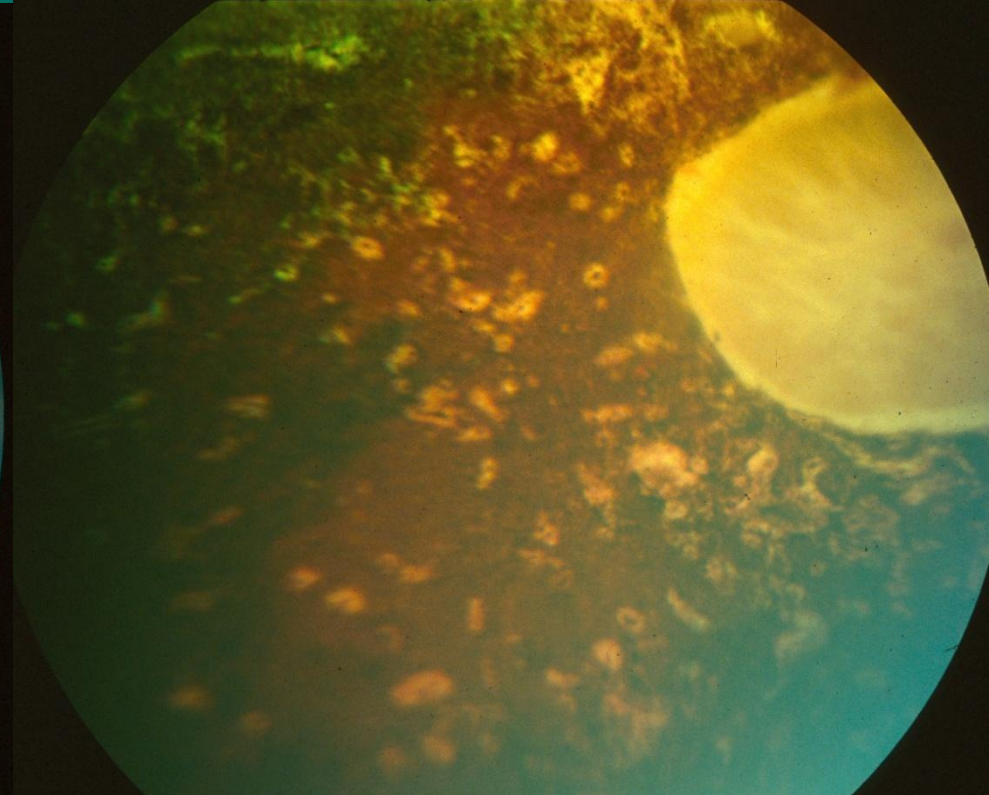
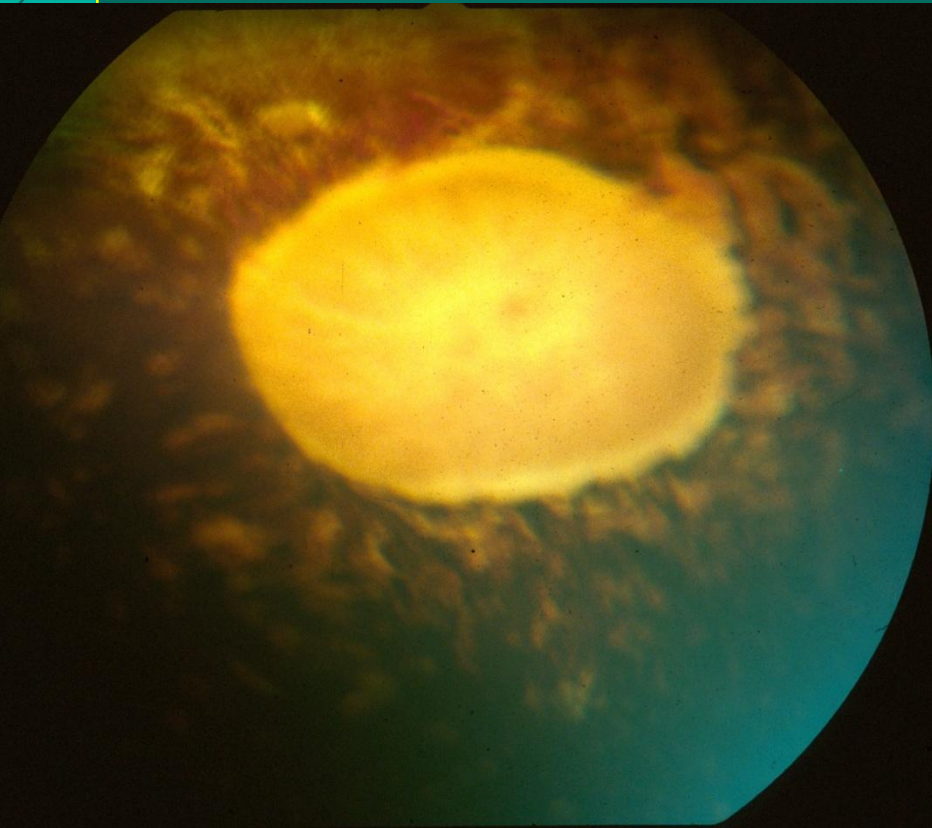




Normal

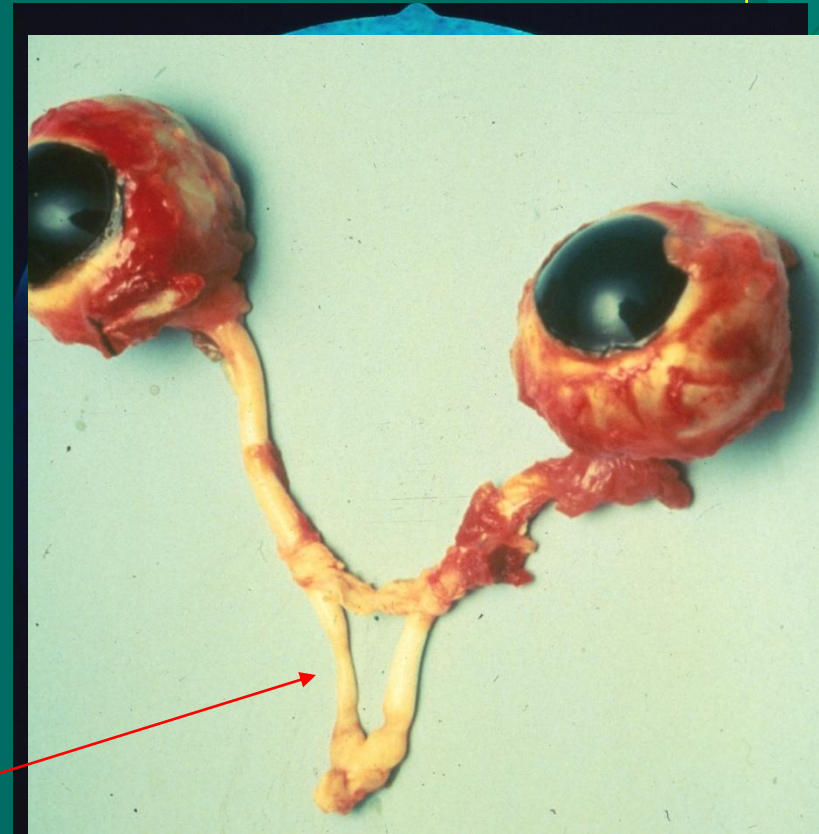
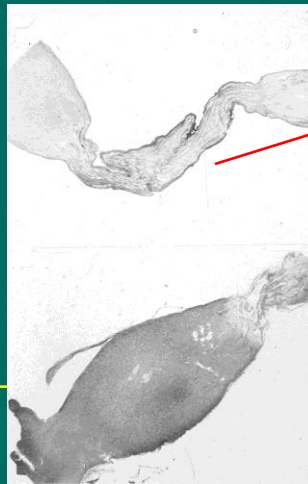


# Chorioretinitis/Optic Nerve Atrophy

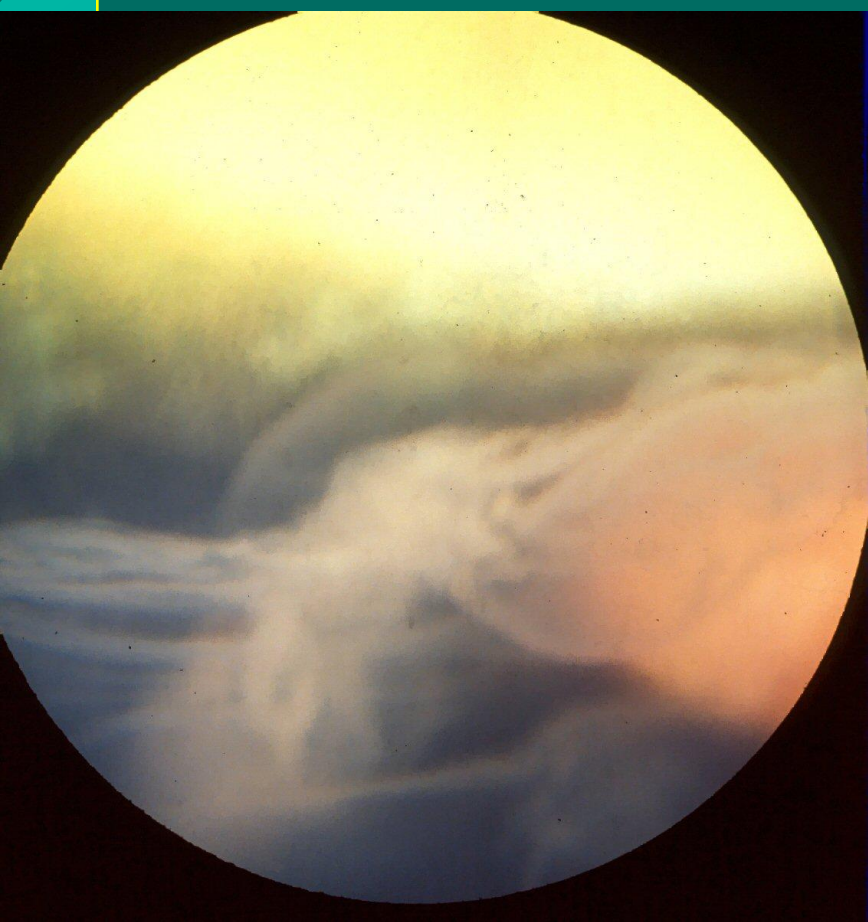


# Traumatic Optic Neuropathy

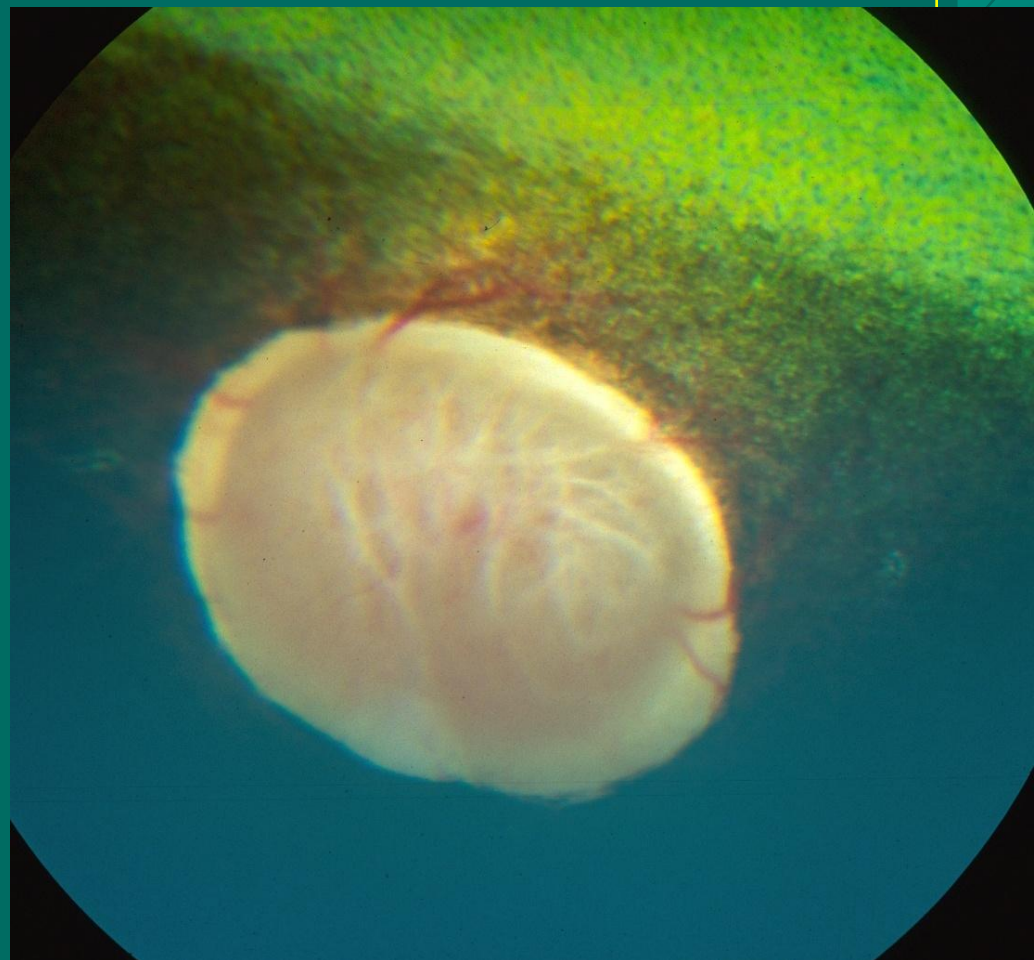
- Trauma to the occipital region causes the globes to move anteriorly.
- The strong optic nerve attachments at the chiasm result in stretching of the optic nerves.







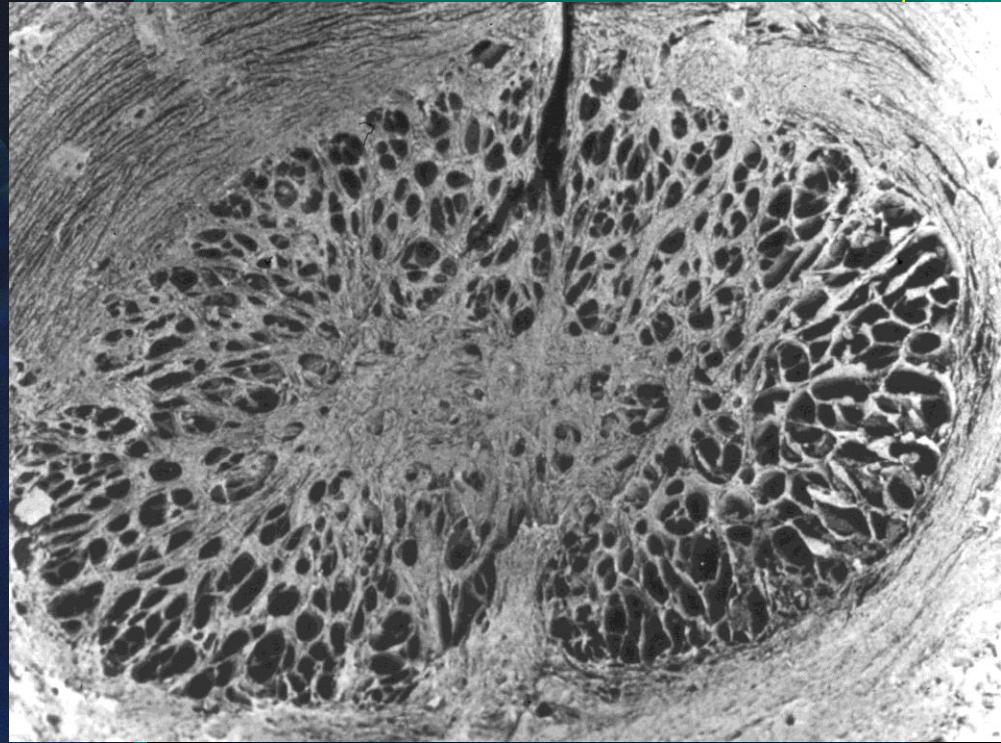
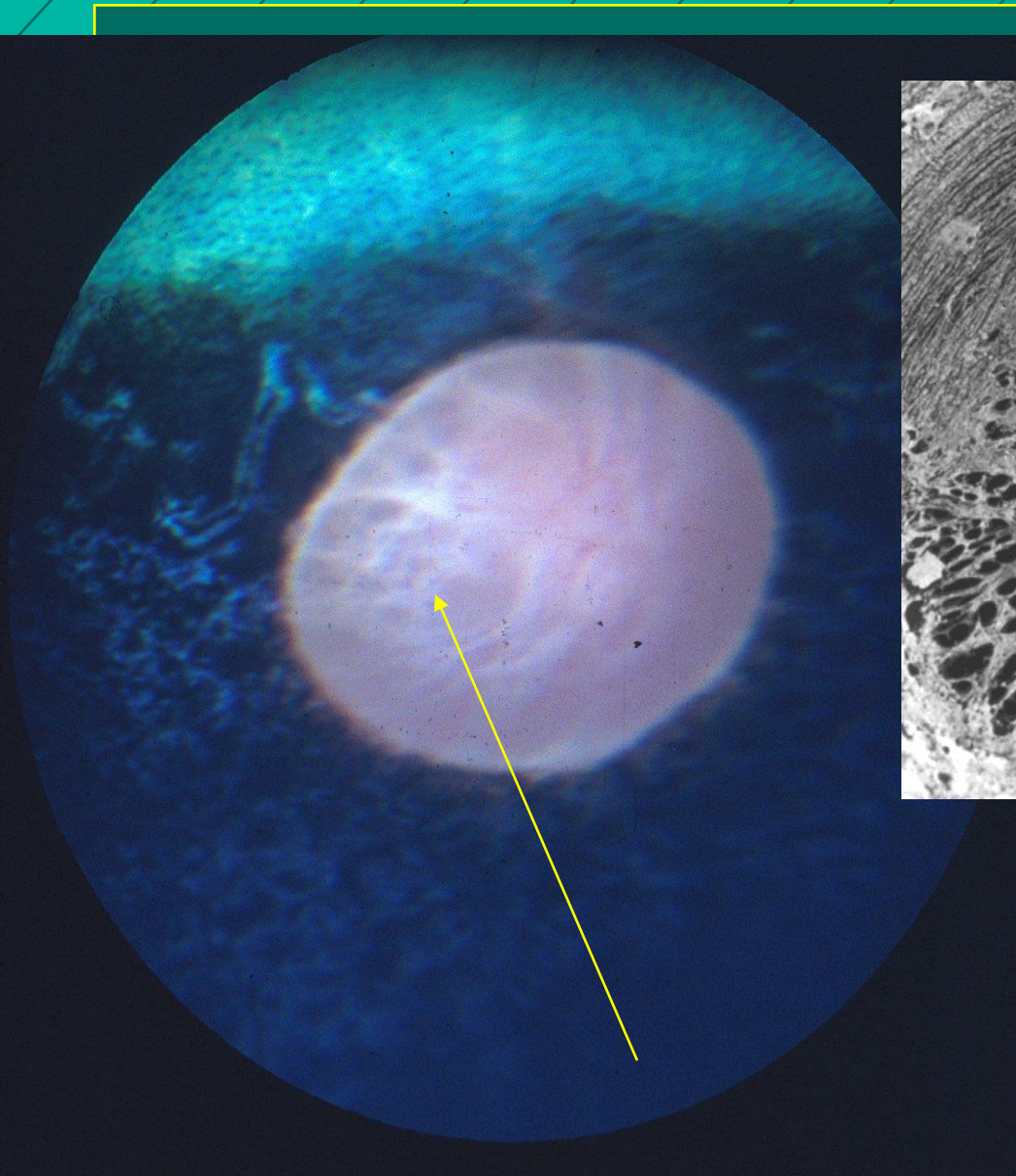
RD



Optic nerve atrophy

Dilated pupils

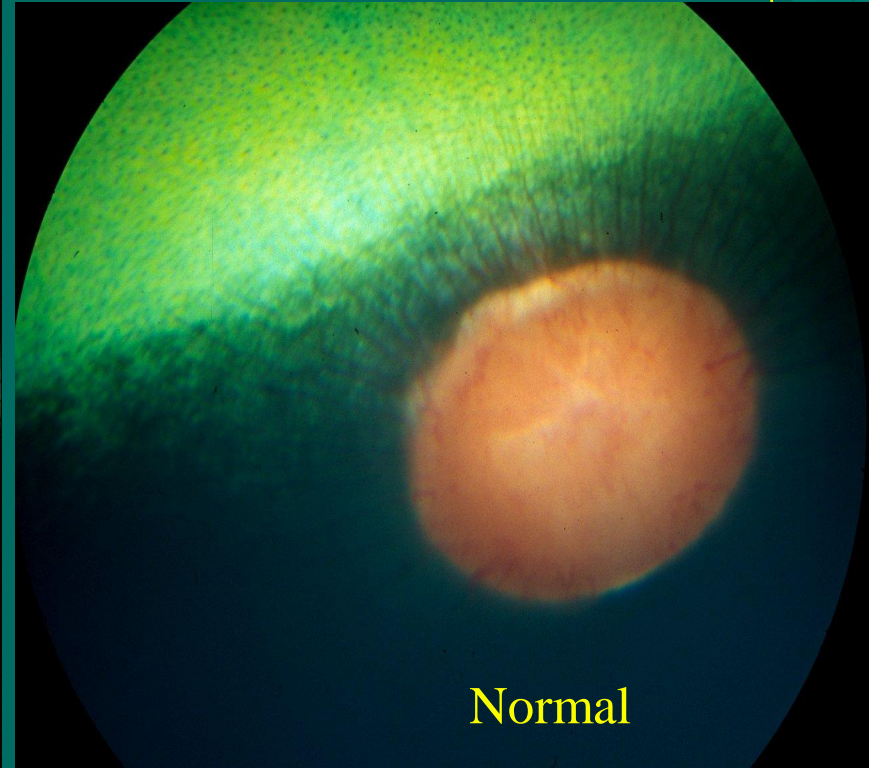
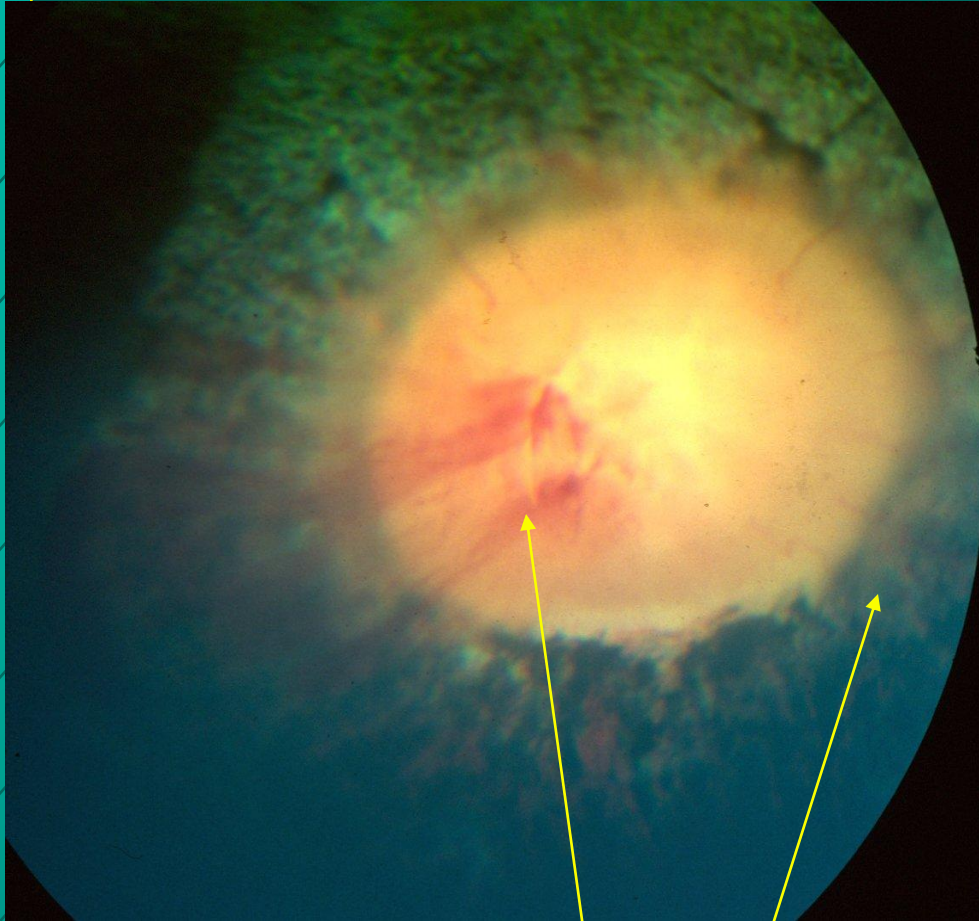




## The Lamina Cribrosa

Exposure of the lamina indicates demyelination

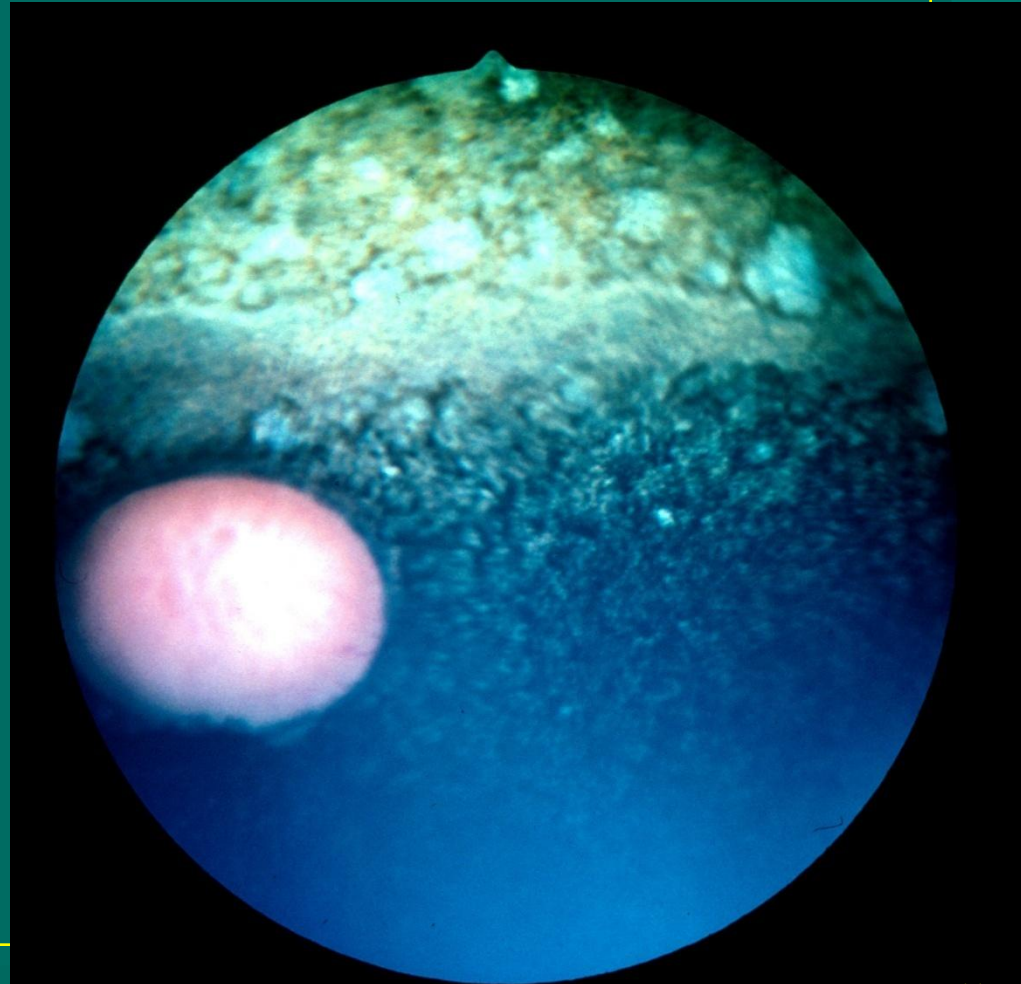




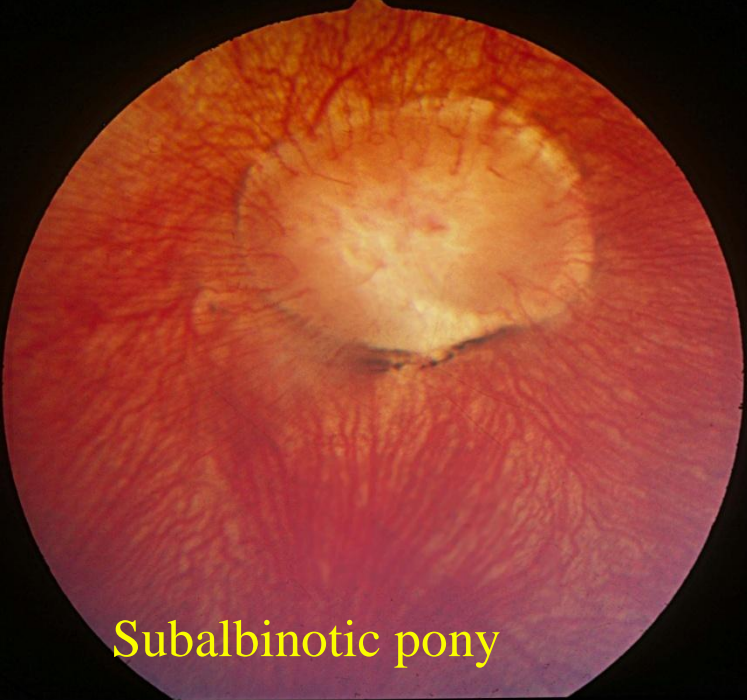
Optic neuritis: hemorrhage and edema from head trauma

# Equine Motor Neuron Disease

- Ceroid lipofuscin in RPE
- Mosaic of yellow/dark
- Vitamin E deficient
  - $<1.799$  microg/ml
- Visual deficits at times
- Therapy does not resolve these lesions



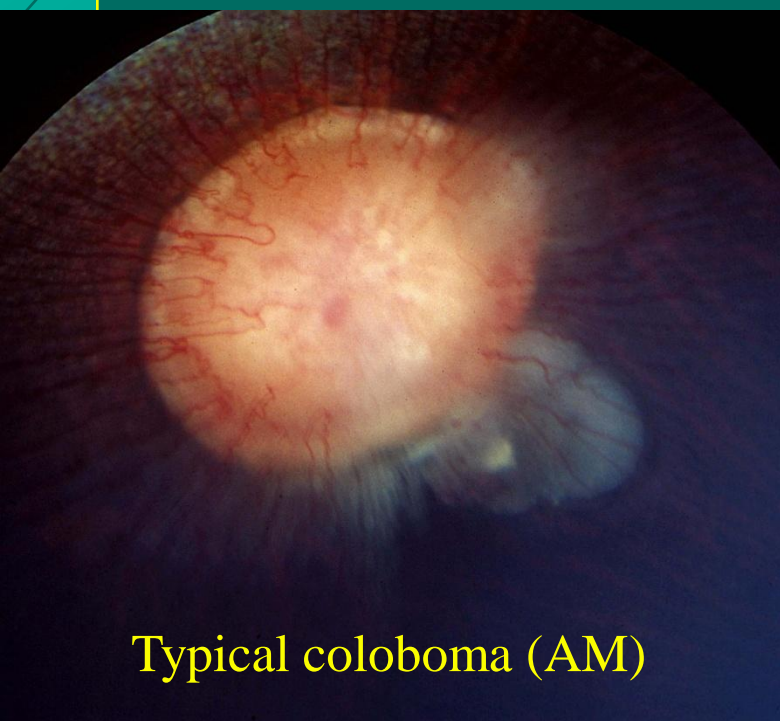




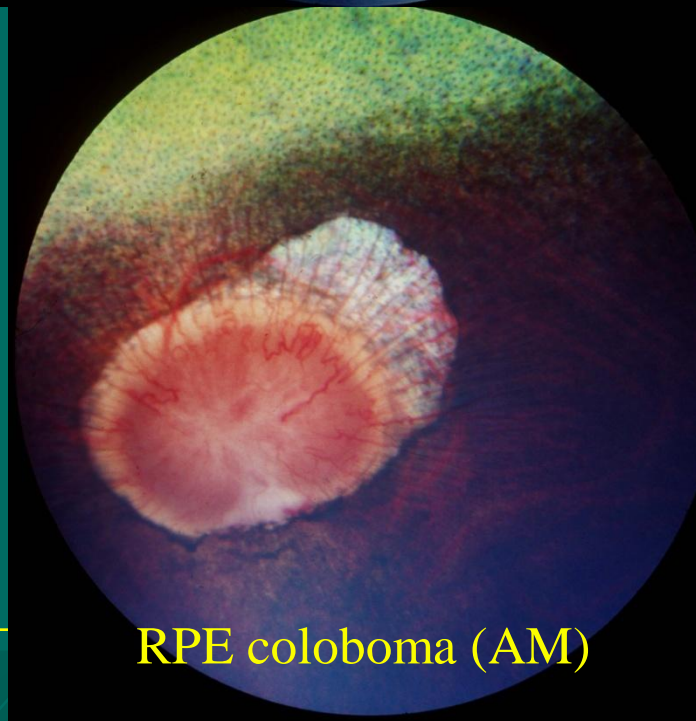
Subalbinotic pony



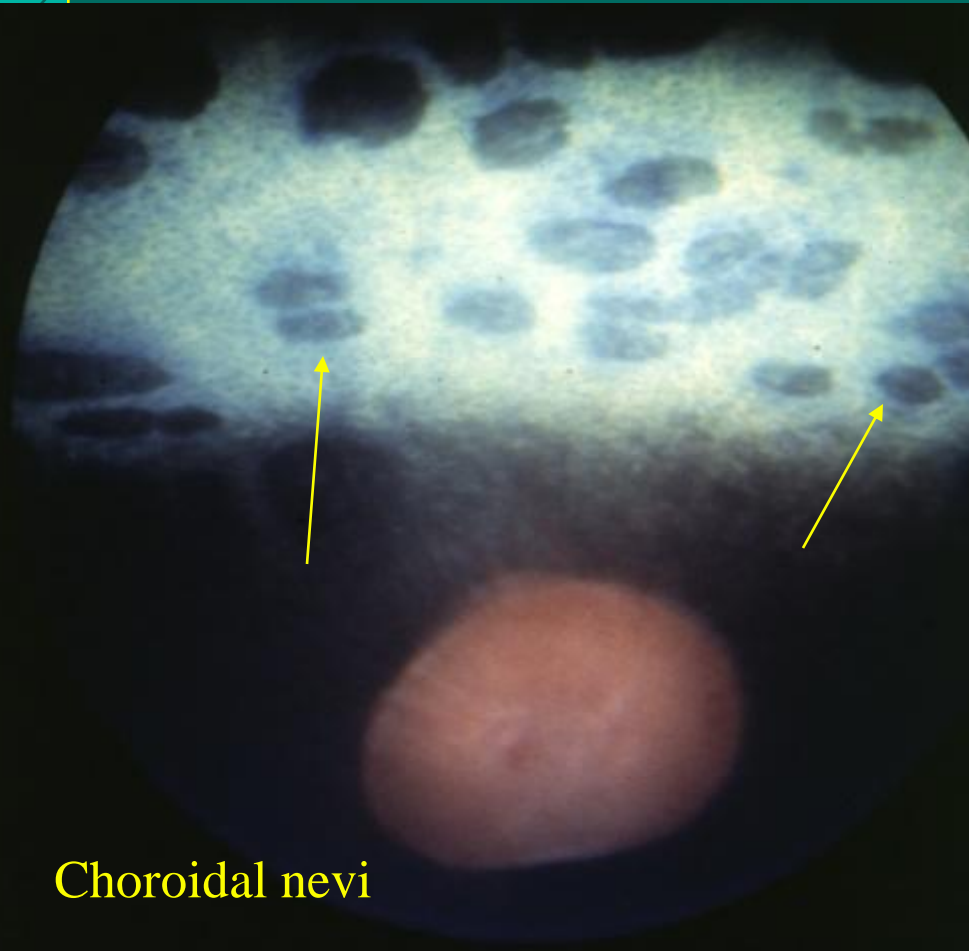
Border tissue of Elschnig



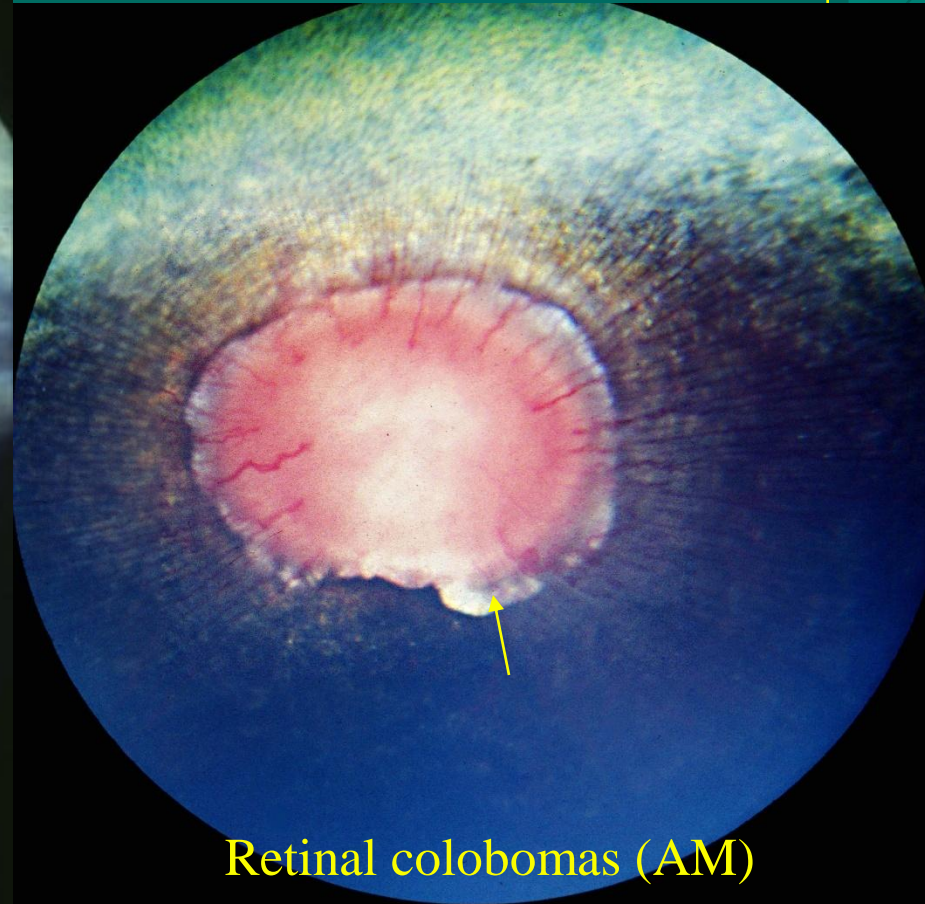
Typical coloboma (AM)



RPE coloboma (AM)

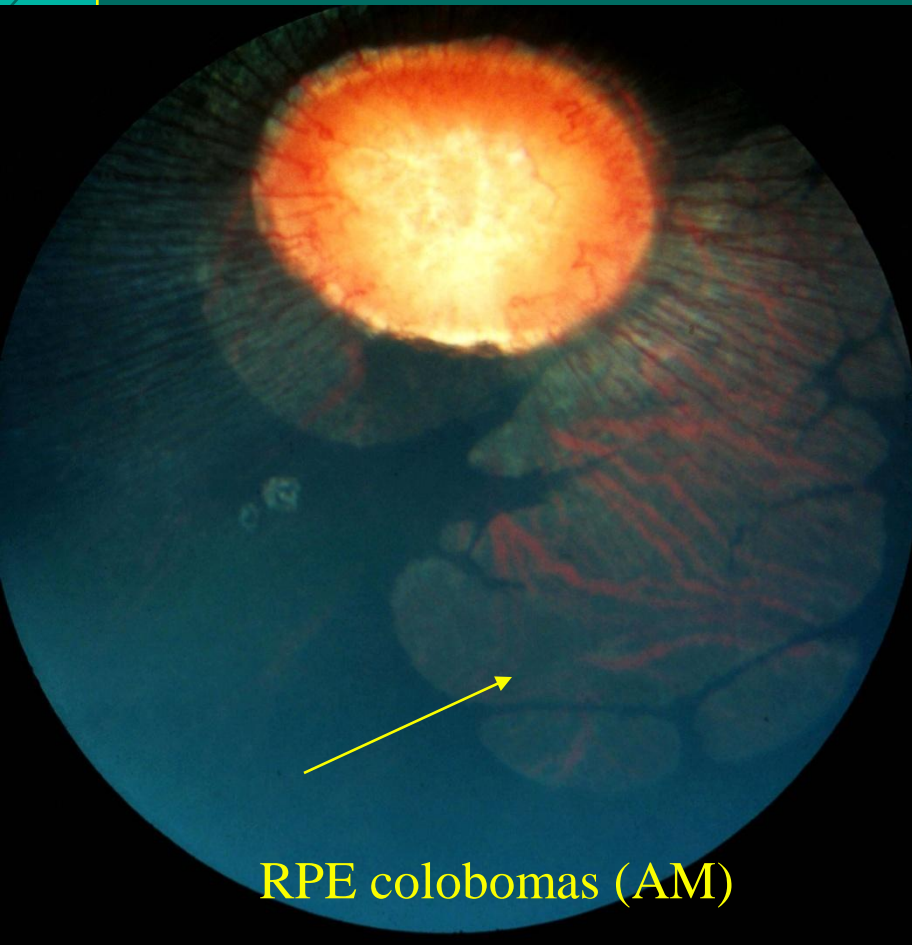


Choroidal nevi

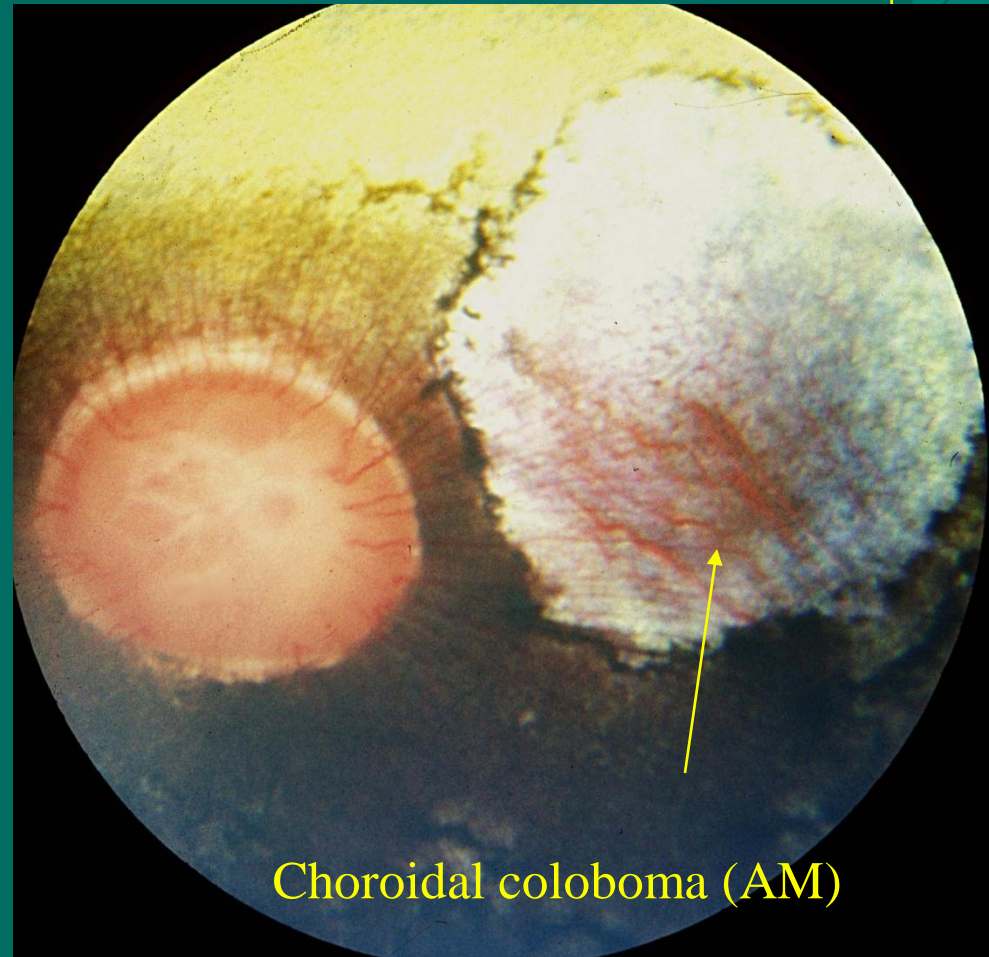


Retinal colobomas (AM)





RPE colobomas (AM)



Choroidal coloboma (AM)