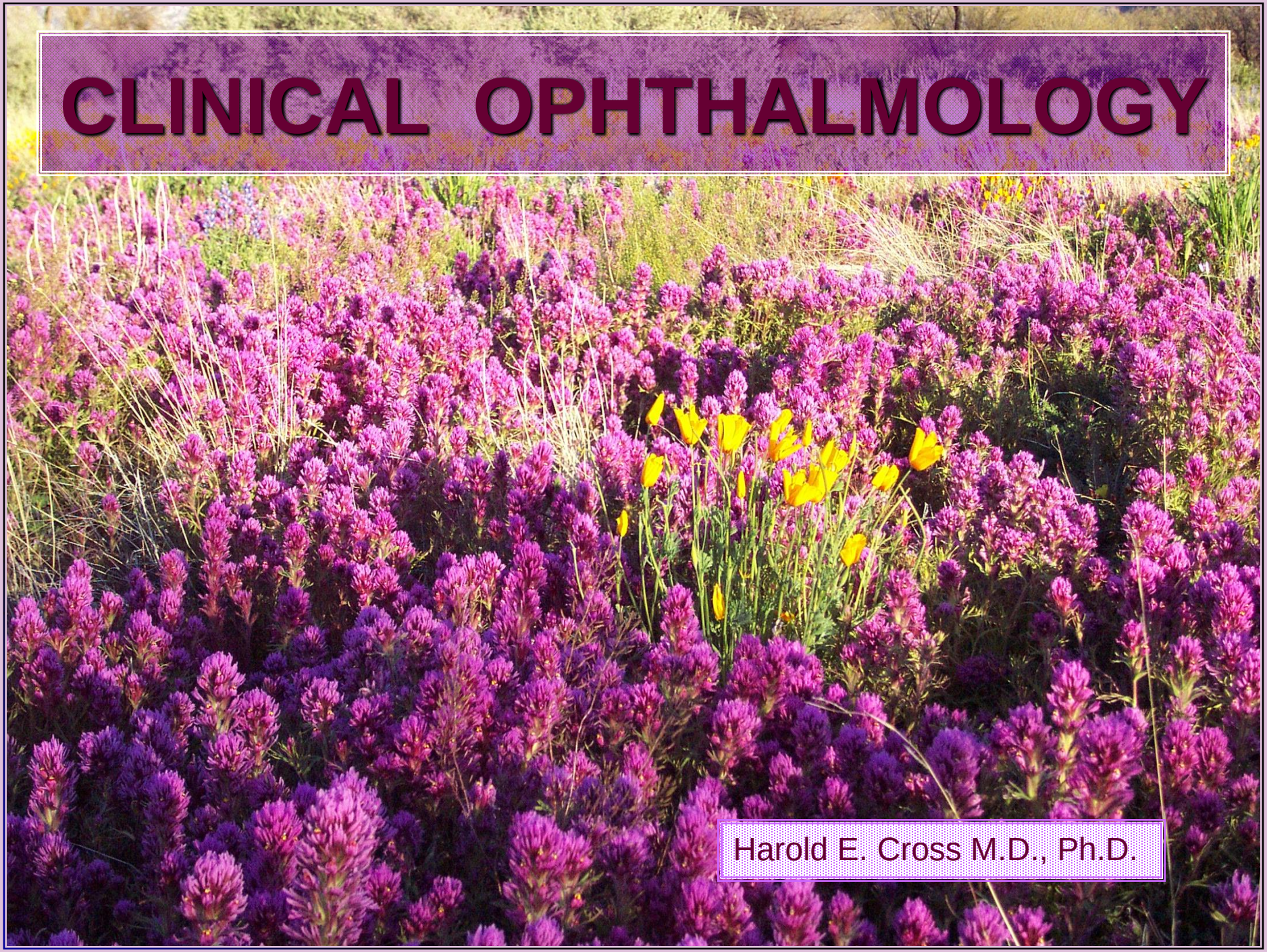
CLINICAL OPHTHALMOLOGY



Harold E. Cross M.D., Ph.D.

Ophthalmology

Department of Ophthalmology website:

http://www.eyes.arizona.edu

Medical student teaching program:

http://www.eyes.arizona.edu/medstudents.htm

Fundamentals of ophthalmoscopy:

http://www.eyes.arizona.edu/FundOph.htm

Ophthalmology

Elective offerings for medical students:

Ophth 815A: Intradepartmental clinical elective. 2-4 weeks available for 4th year or part of 3rd year surgical elective

Ophth 815B: Similar to 815A but in private offices of affiliated faculty, limited to 4th year students only

Ophth 815P: Phoenix clinical elective 2-4 weeks, 4th year only

Ophth 800: Elective research rotation within Department, time and project variable, 4th year only

Ophth 891A: Extended research opportunities for 4th year students interested in ophthalmology as a career

OPHTHALMOLOGICAL CONTRIBUTIONS to MEDICAL SCIENCE

1950's First tissue homograft (cornea) to achieve high success rate in clinical practice

1960's First demonstration of lyonization in humans (in X-linked ocular disorders such as ocular albinism and chorioderemia)

1971 "Two-hit hypothesis" of tumor causation developed by Knutson using the ocular model of retinoblastoma

1970's Abnormal crossing of visual fibers demonstrated in human albinos

1986 The first recessive human oncogene located, cloned and sequenced in an ocular tumor (retinoblastoma)

What is ophthalmology?

Webster's Unabridged:

The branch of medical science dealing with the anatomy, functions, and diseases of the eye

Herman von Helmholtz:

Ophthalmology is for medicine what astronomy is for physics: the Model

Why study ophthalmology?

“THE EYE IS A WINDOW TO SYSTEMIC DISEASE”

WHAT DO I NEED TO KNOW?

Anatomy and physiology of vision

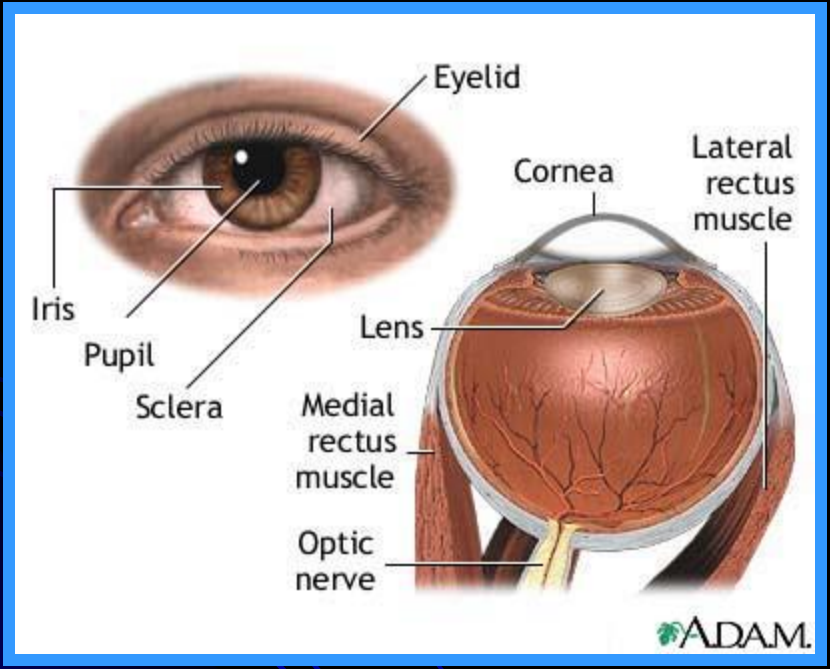
How to elicit a valid ocular history

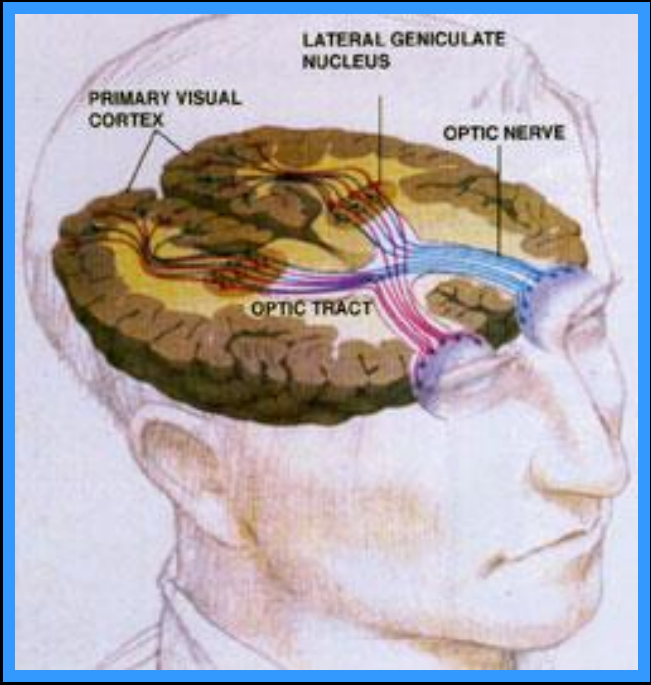
How to perform an eye examination

Learn about common eye diseases and their treatment

Understand the presentation and significance of the more important ocular diseases

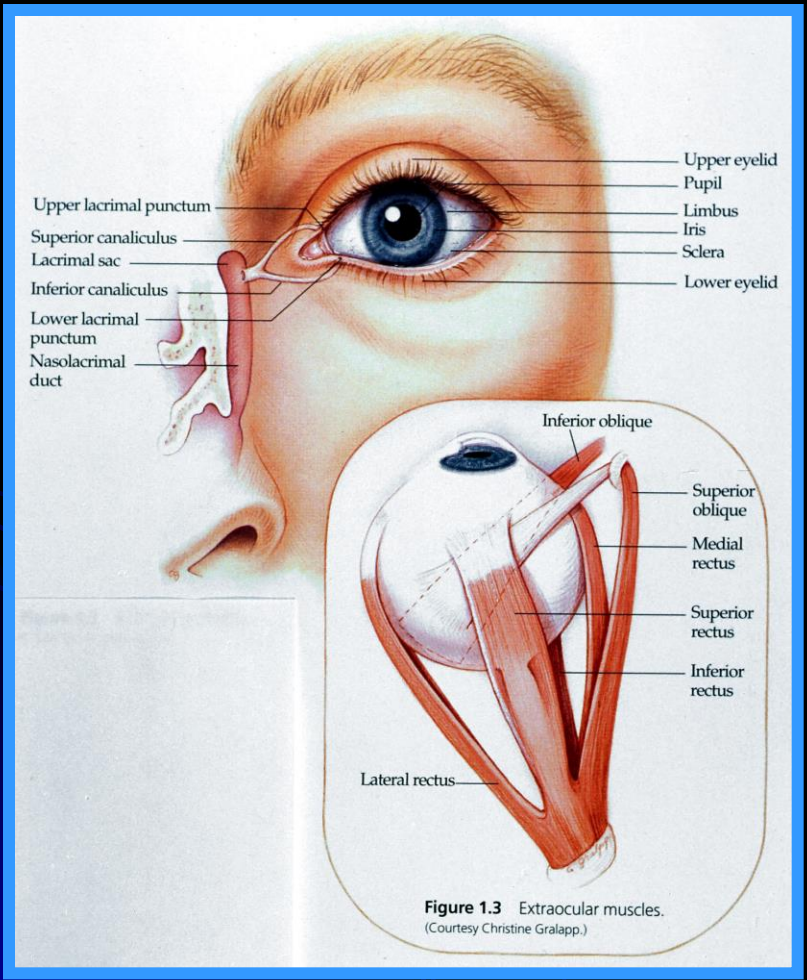
Anatomy of human vision



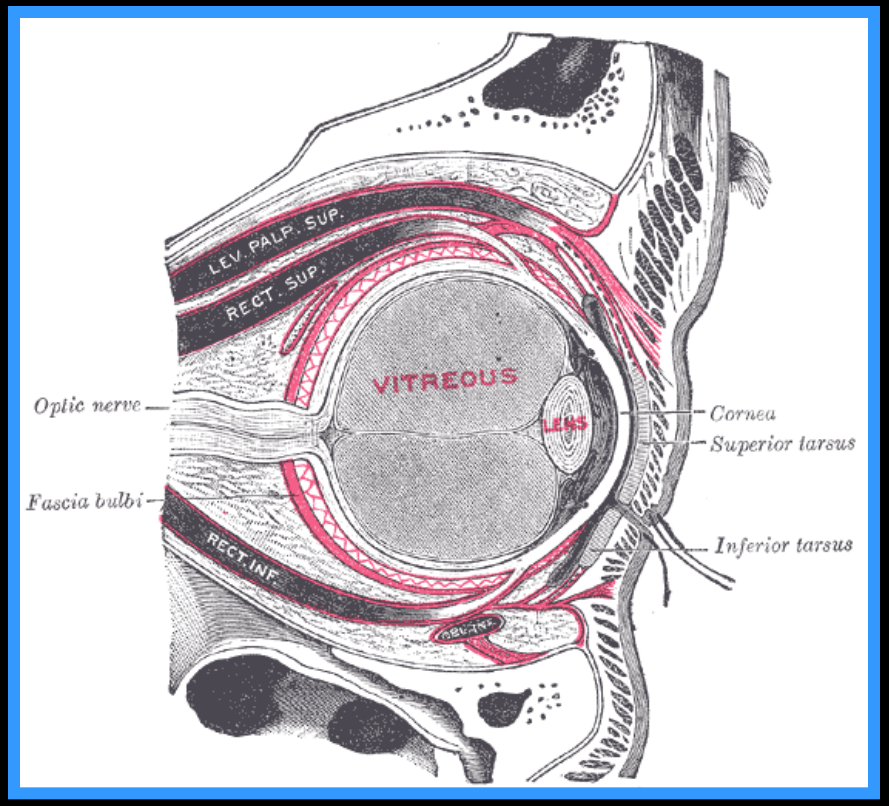


The eyeball and it's connections

Anatomy of human vision

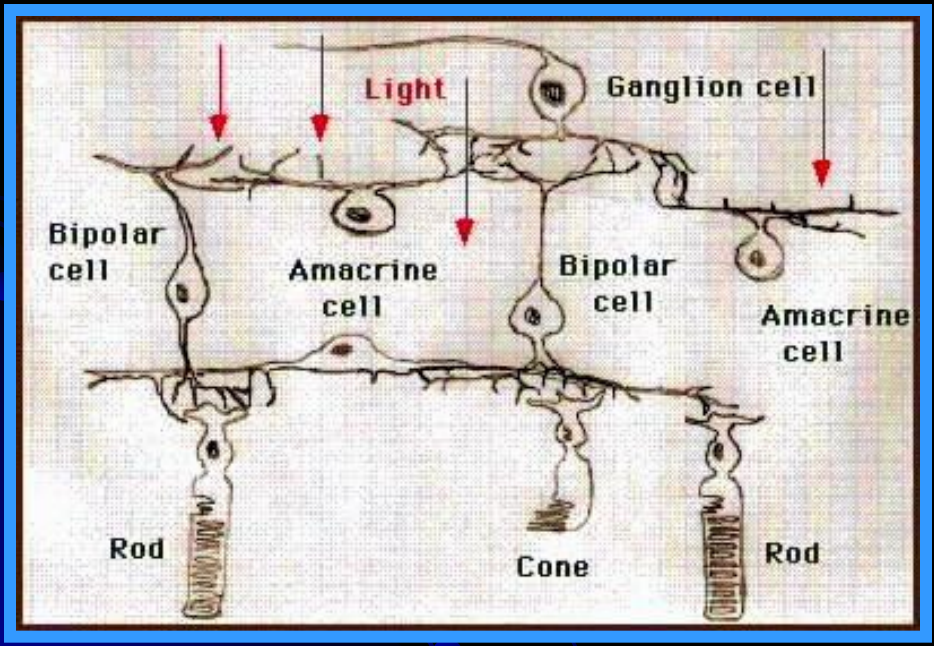


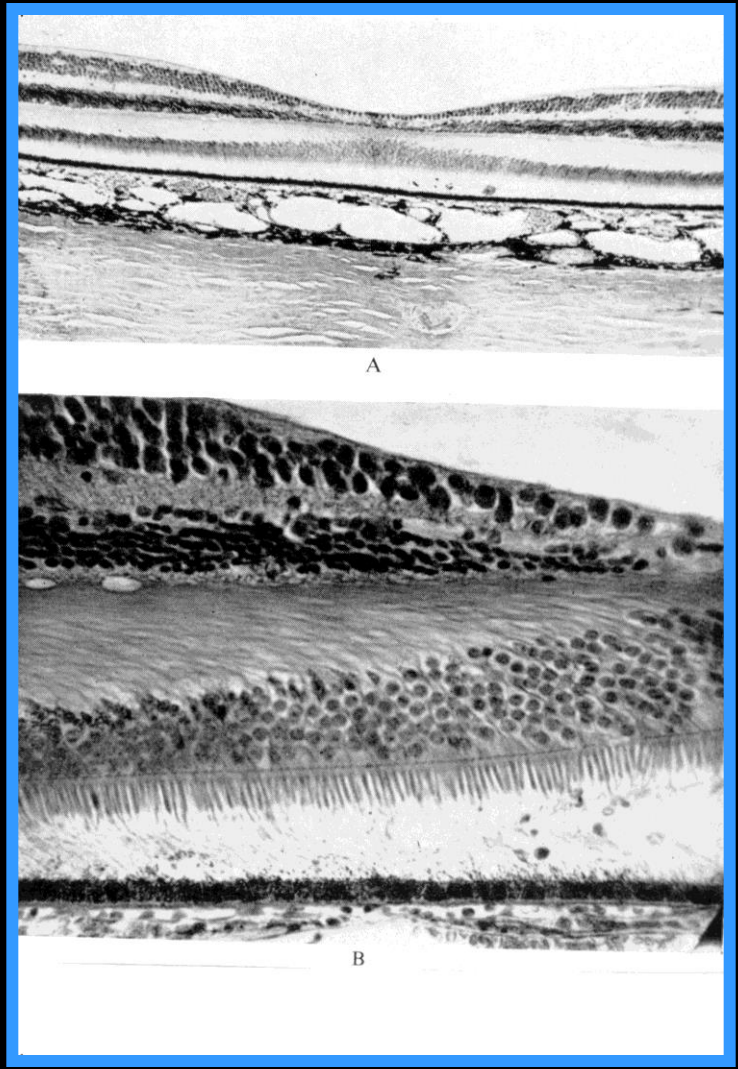
Associated structures



Anatomy of human vision

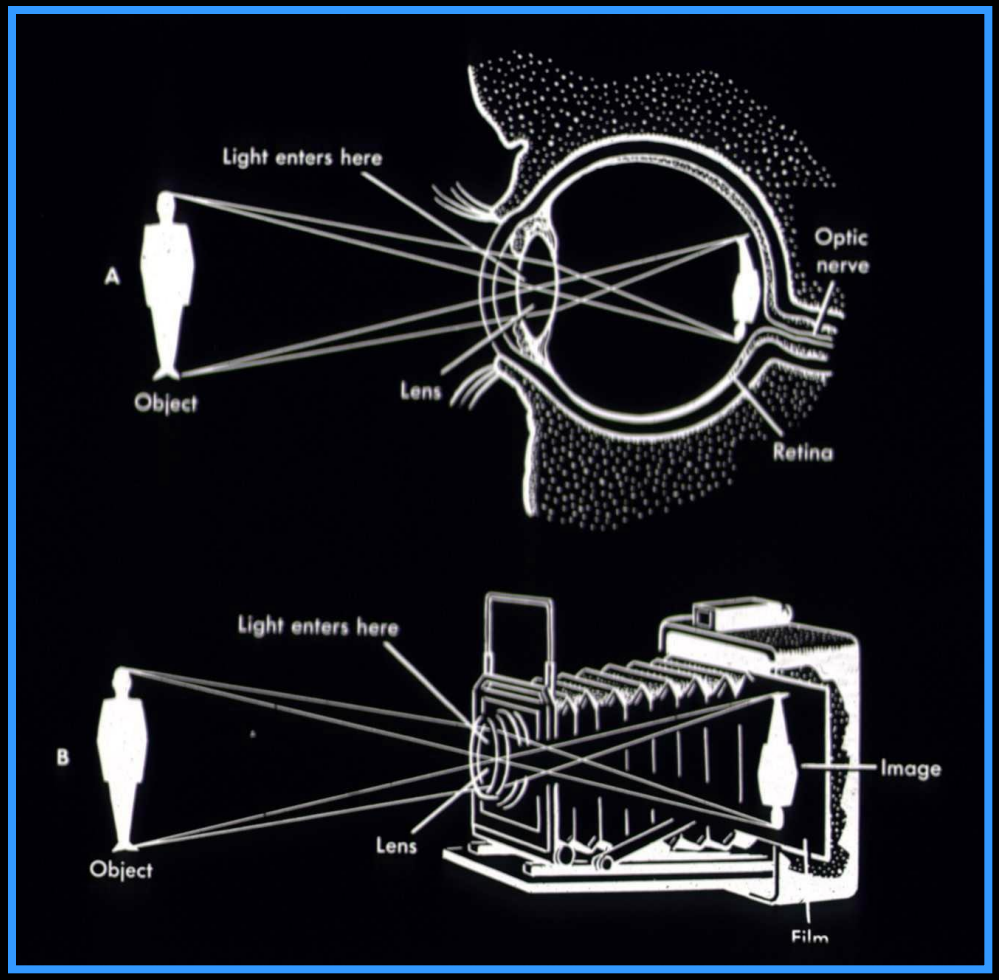
The retina





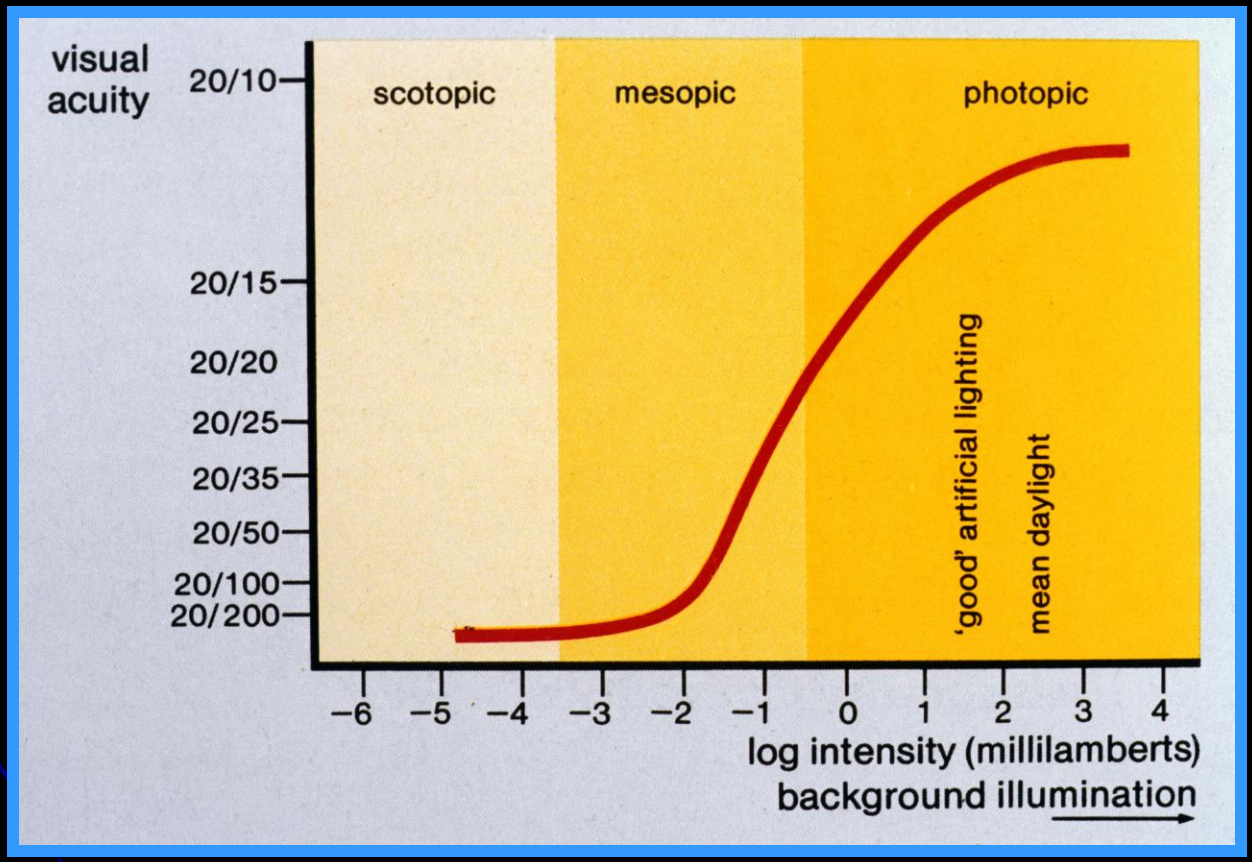
Physiology of human vision

How does the eye work?

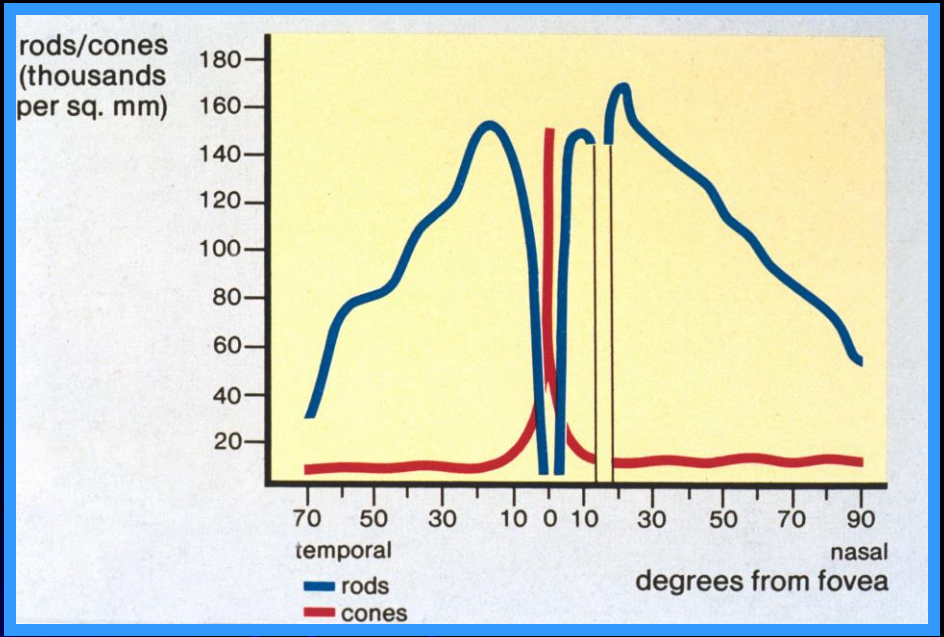


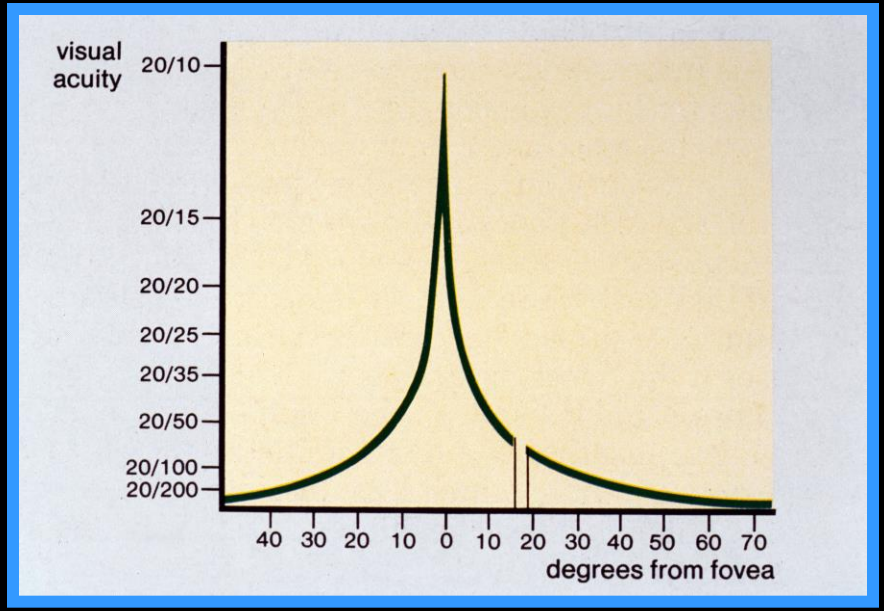
Physiology of human vision

We see best in bright light!



Correlation of acuity and retinal histology





The ophthalmic history

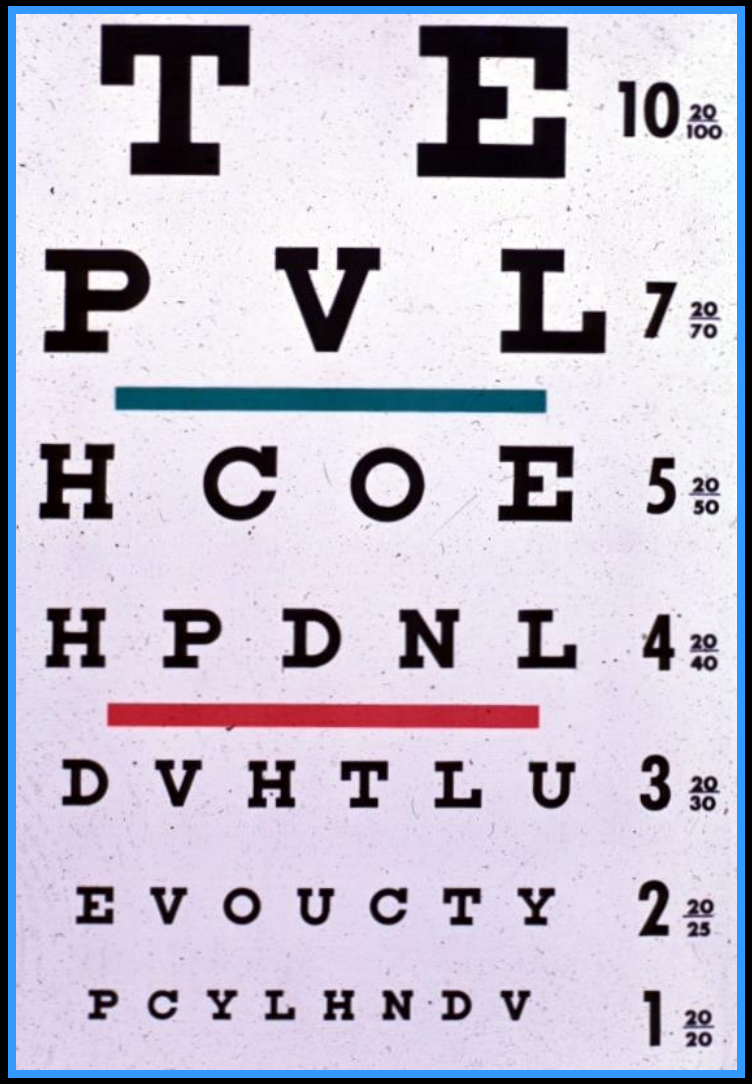
A. Chief complaint
B. Onset, duration, and severity of symptoms
C. Associated ocular symptoms such as changes in vision, photophobia, photopsia, pain, redness, discharge, diplopia
D. Systemic symptoms, disease, drugs, etc.
E. Prior ocular surgery and/or treatment

The ocular examination

A. Measuring visual function (acuity)
B. External, direct examination (use focused light)
    1. Alignment and motility
    2. Lid and pupillary functions
    3. Degree, type, and location of conjunctival injection
C. Internal examination
    1. Note clarity of media
    2. Disc color and morphology
    3. Macular pigmentation and lesions
    4. Appearance of retinal vessels
    5. General appearance of retina and RPE

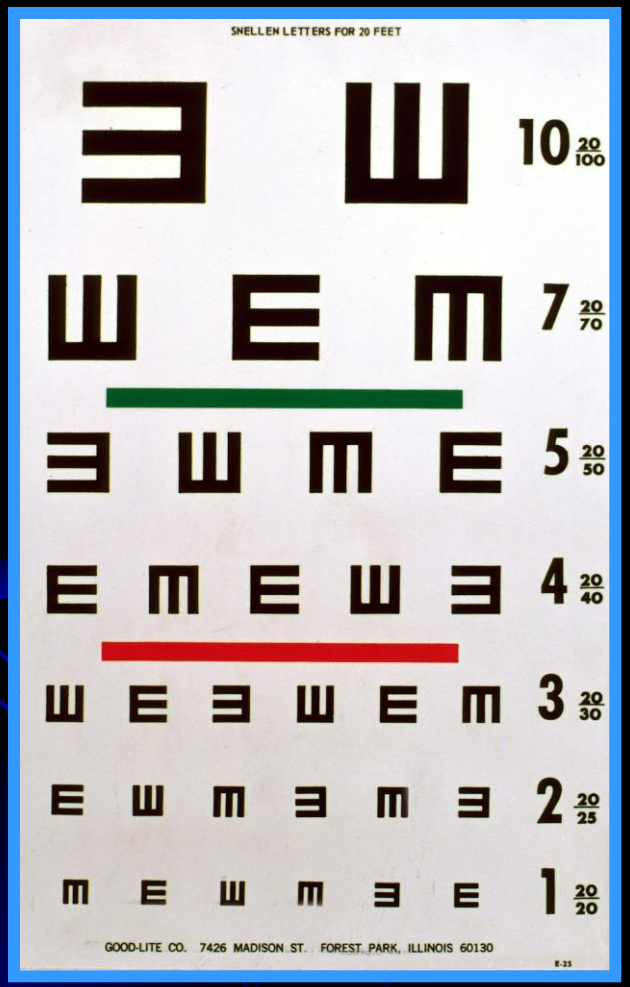
How do we measure vision?

Snellen eye chart



How do we measure vision?

Illiterate "E's"



Tumbling E

Allen pictures

THE VISUAL FIELD

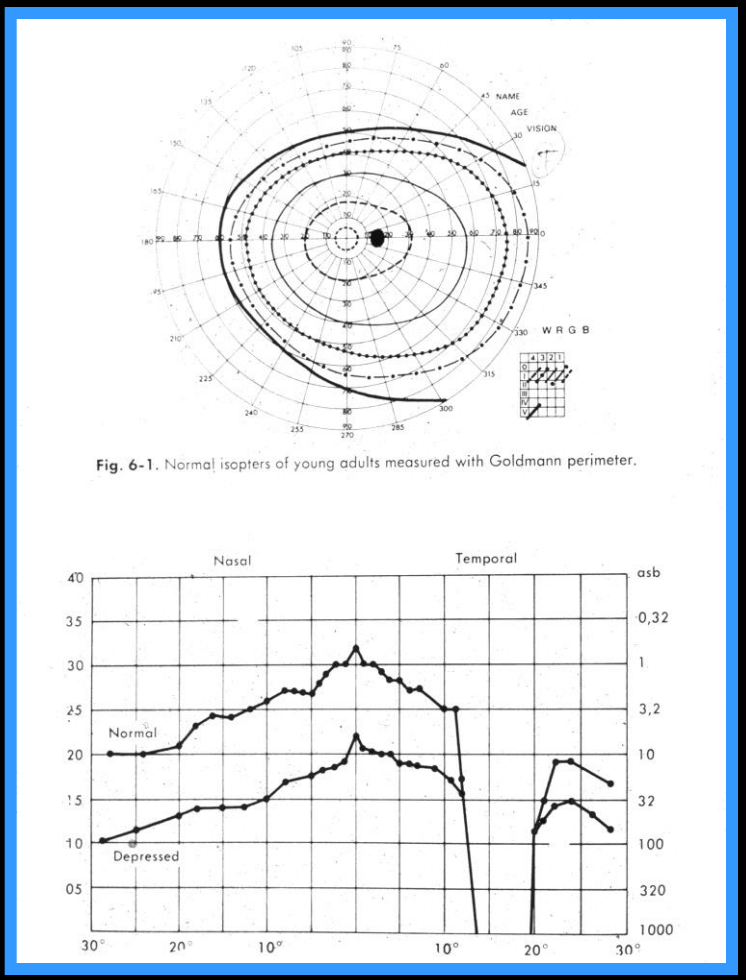
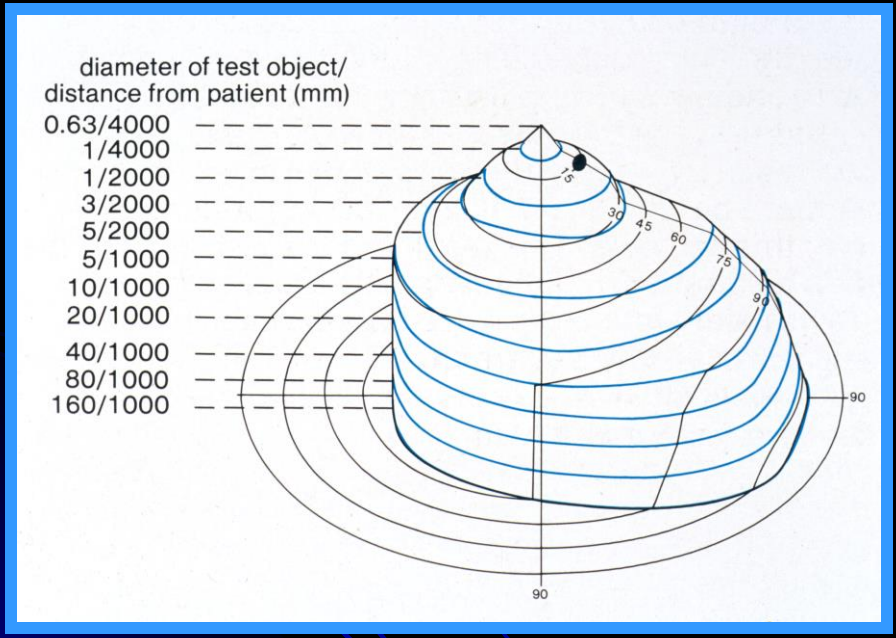
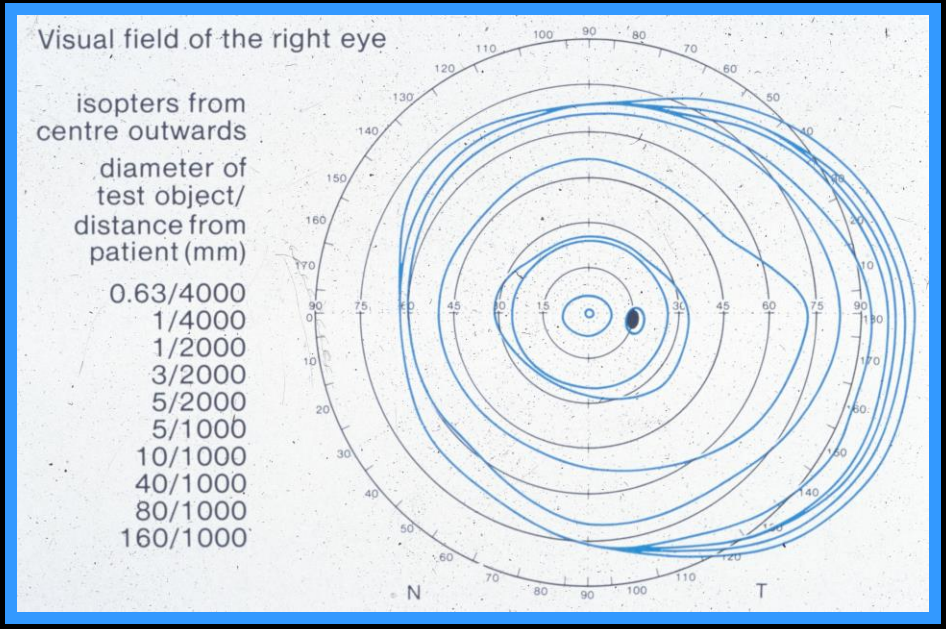


Fig. 6-1. Normal isopters of young adults measured with Goldmann perimeter.

Goldmann perimetry

THE VISUAL FIELD

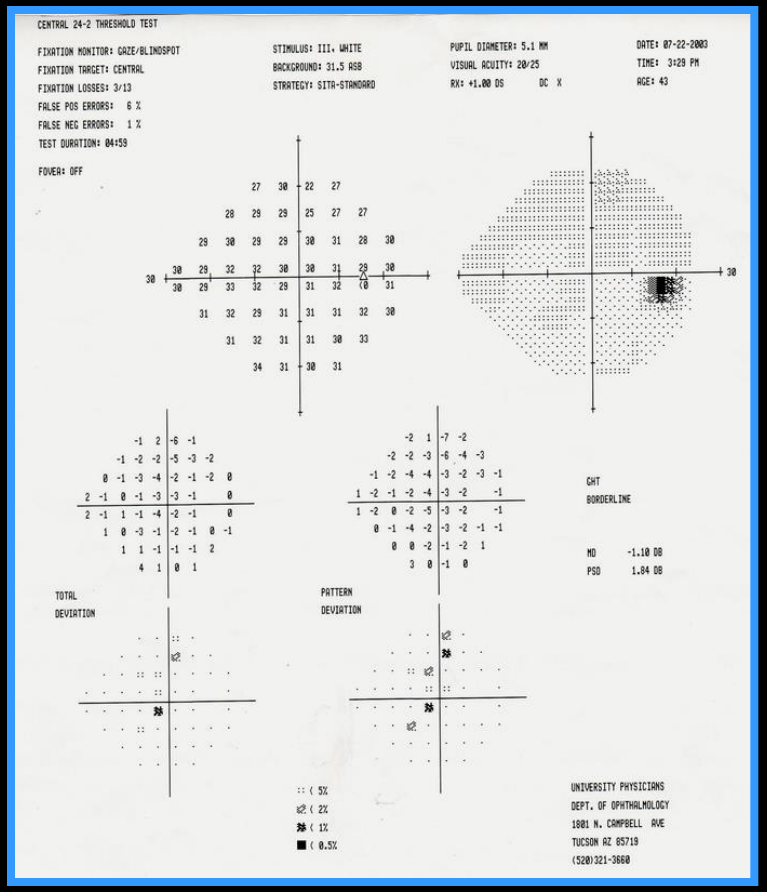




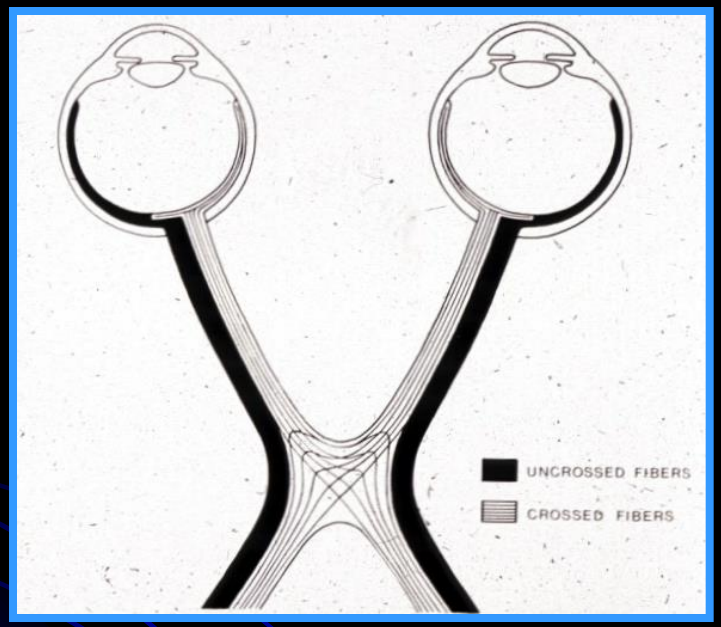
“An island of vision in a sea of darkness”

THE VISUAL FIELD

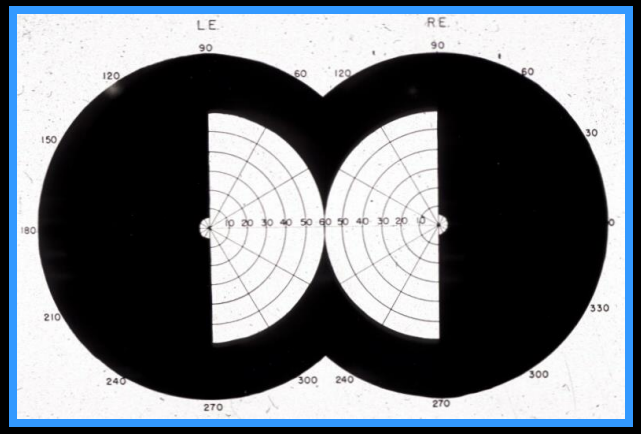
Humphrey automated perimeter



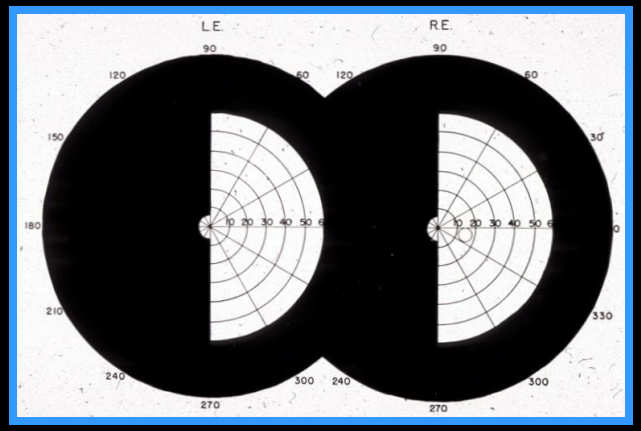
THE VISUAL FIELD



Anatomic relationship of retinal axons at chiasm



Bitemporal hemianopia



Left homonymous hemianopia

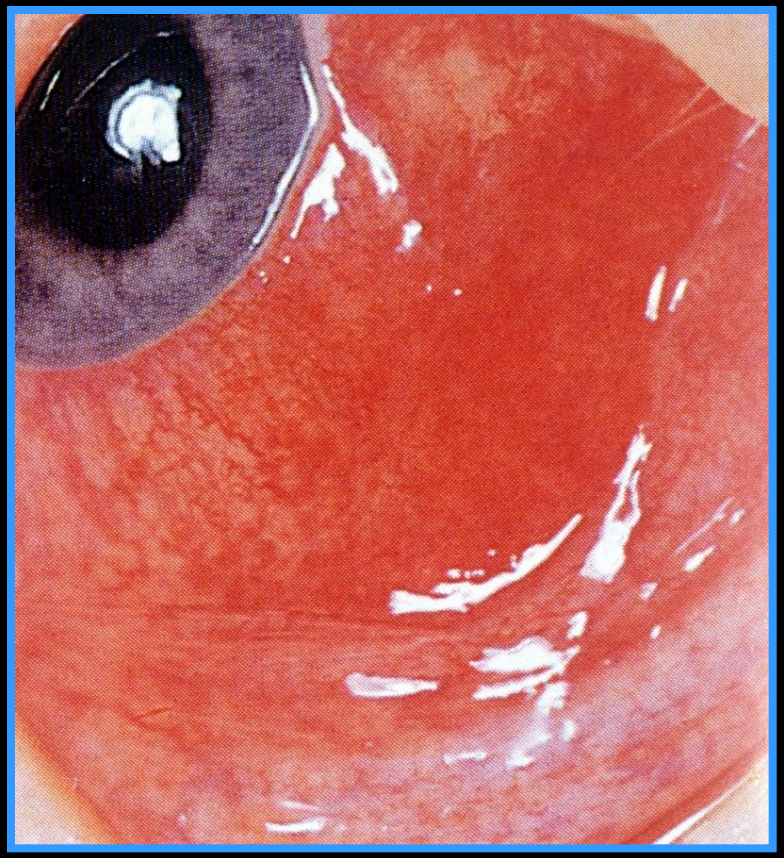
External examination

External examination

External examination

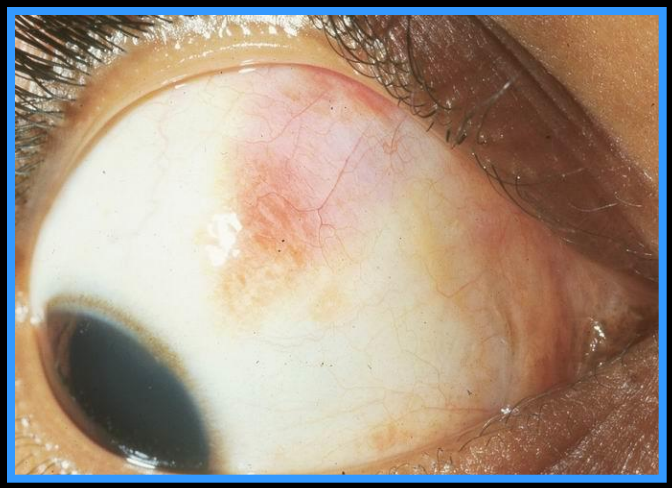
External examination

Subconjunctival hemorrhage



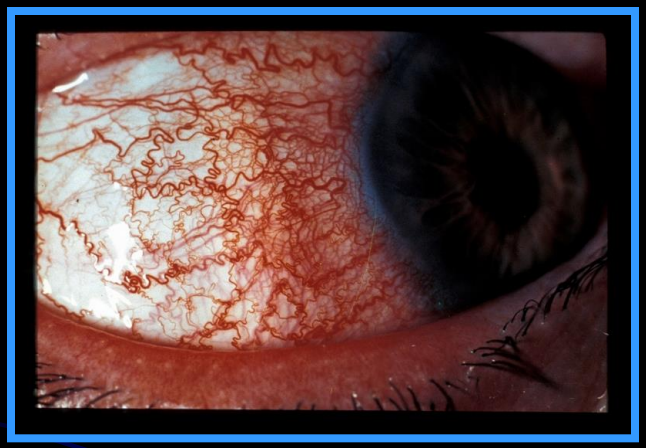
Conjunctival injection

External examination

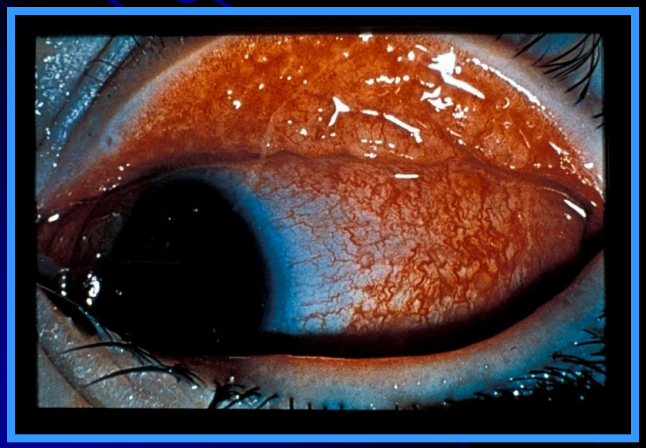


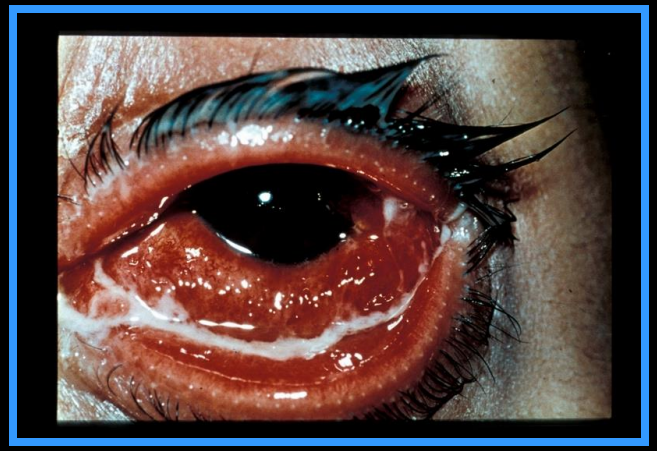
Subconjunctival hemorrhage

External examination



Conjunctival injection

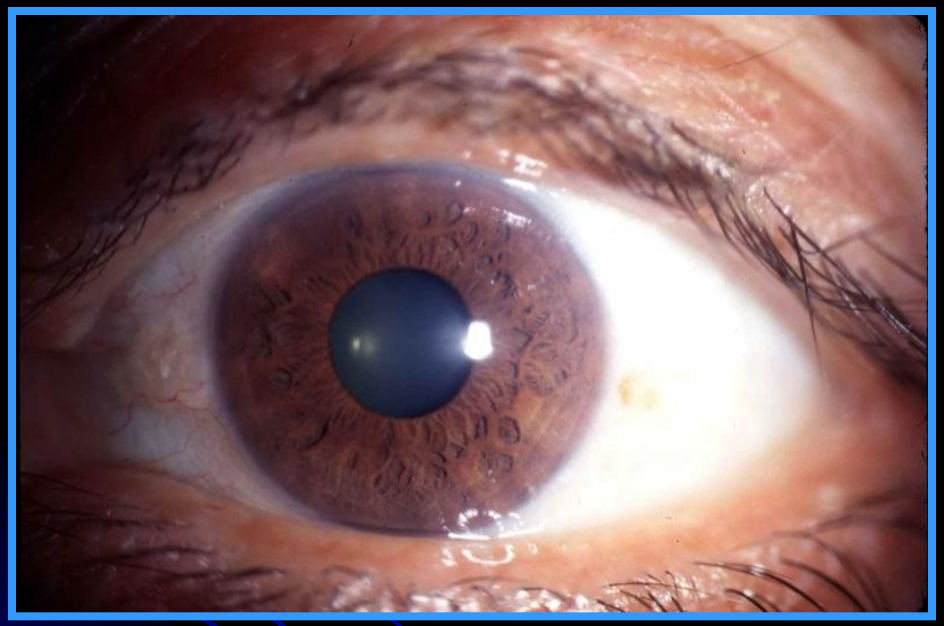




External examination

Conjunctival disease

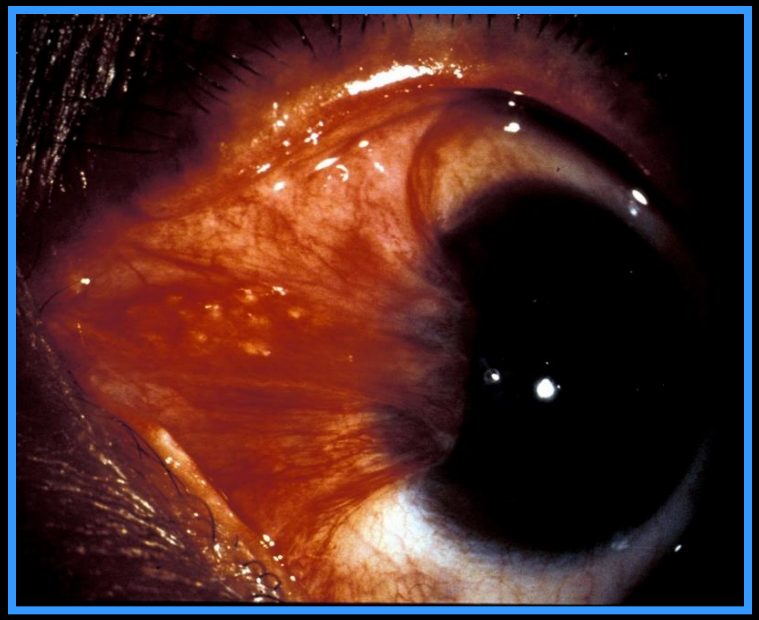
External examination



Pingueculum

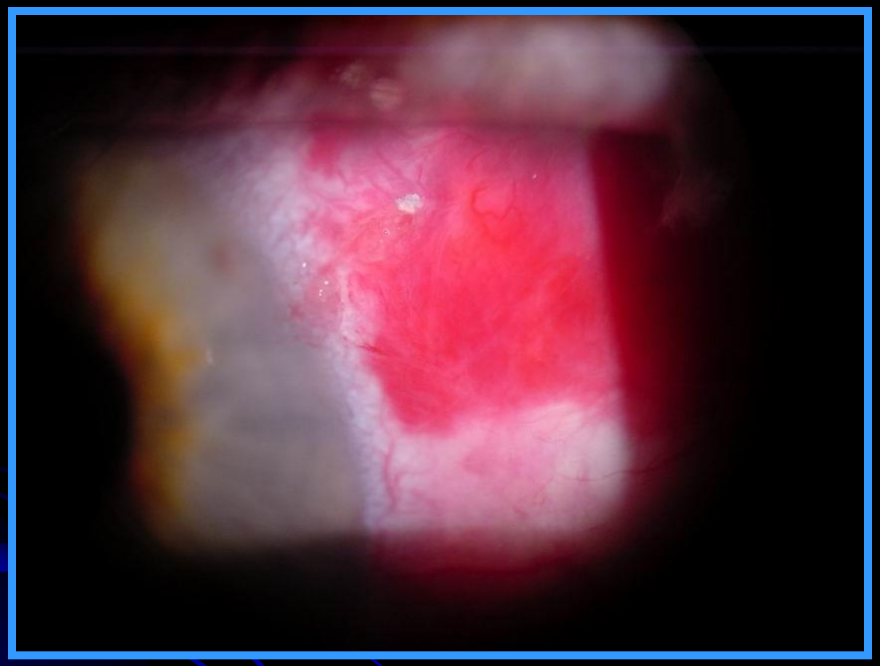
Pterygium

External examination



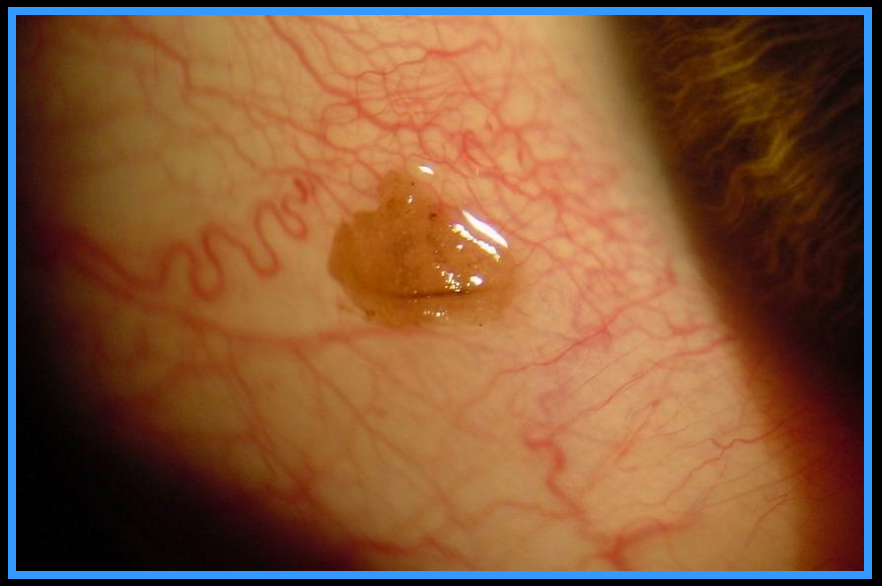
Pterygiae

External examination

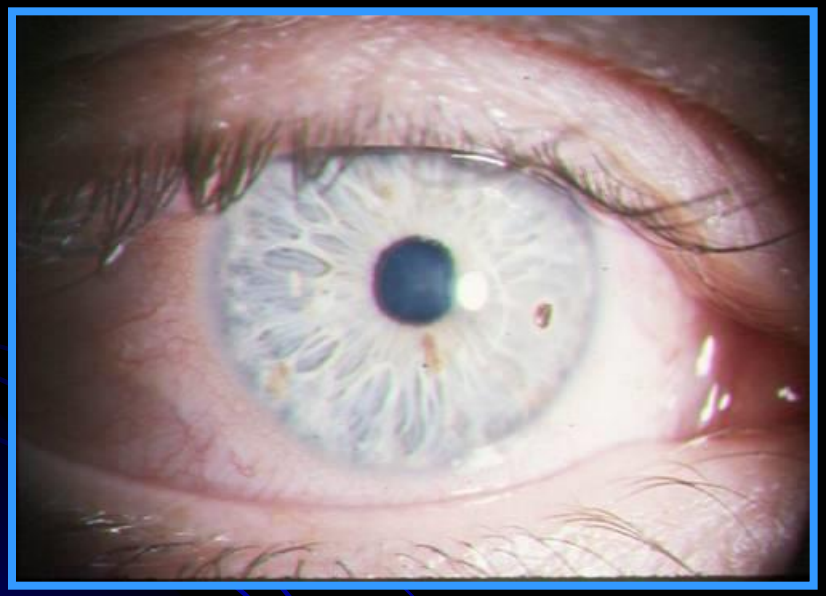


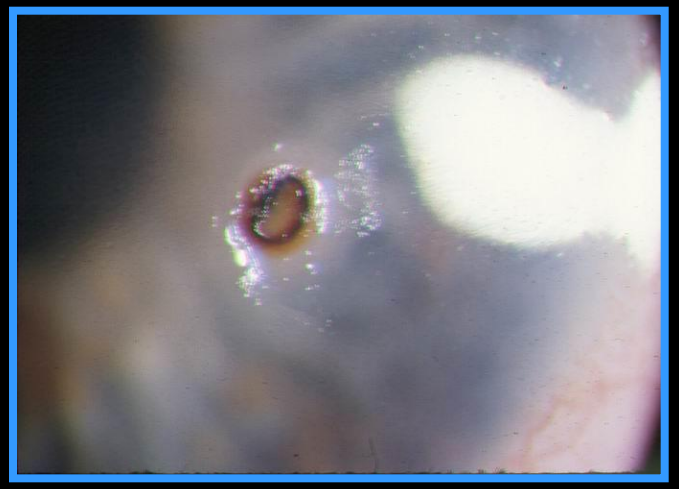
Metallic foreign body

Organic foreign body



External examination





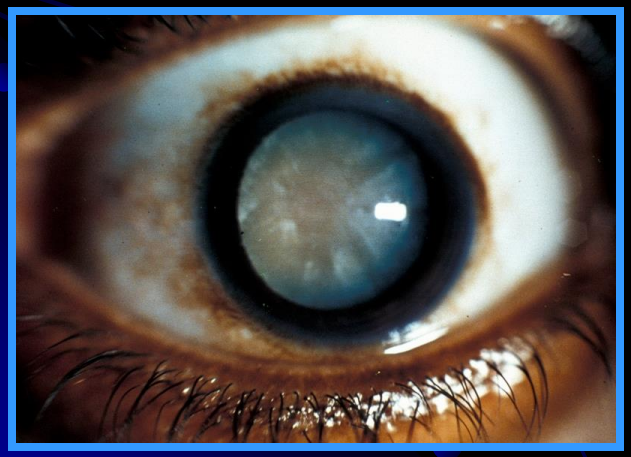
Corneal foreign bodies

External examination

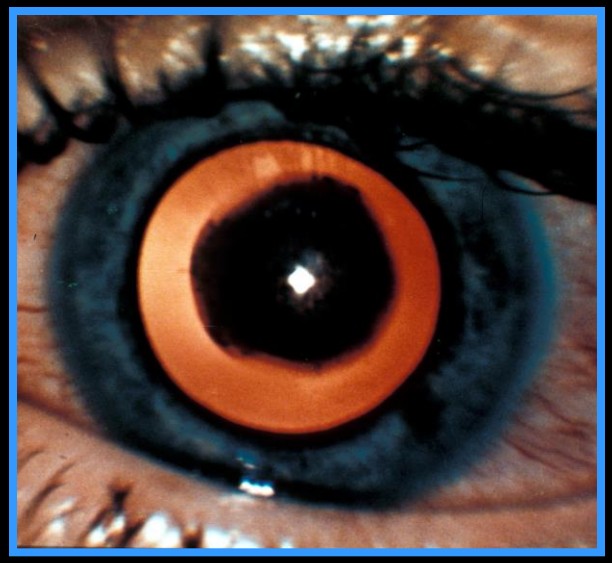
Lid foreign bodies

Ophthalmology

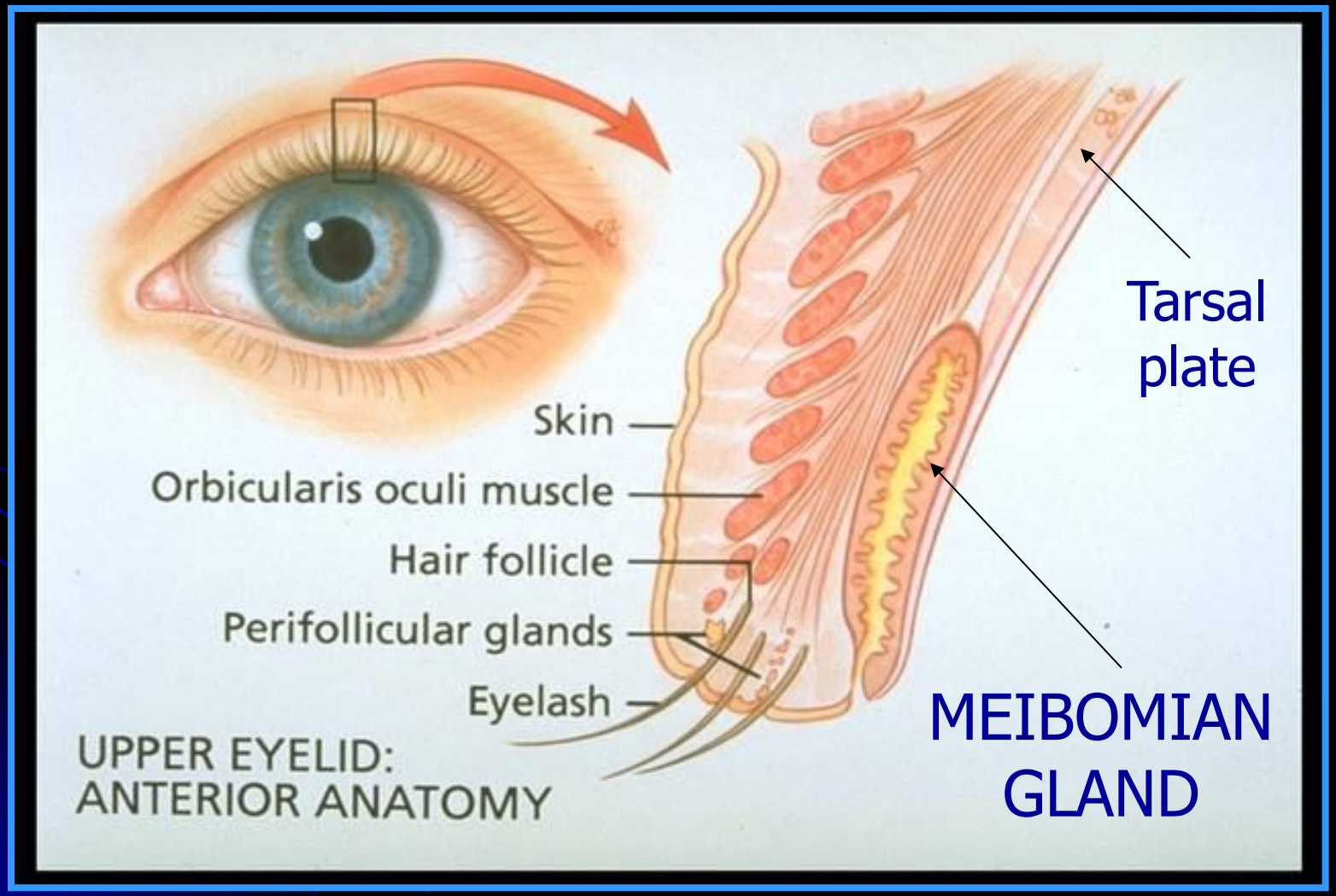
External examination



Cataracts



Eyelid anatomy



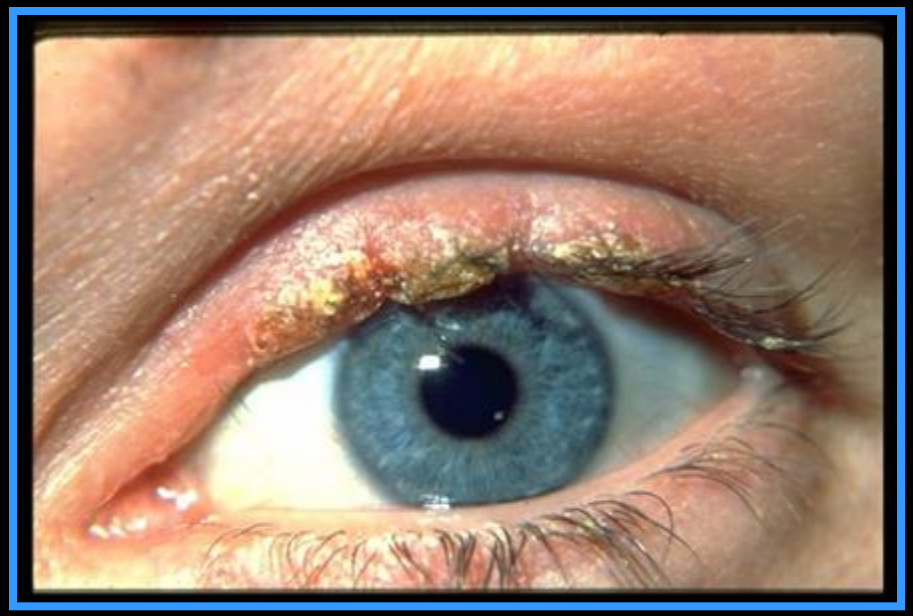
External examination

Staph folliculitis/blepharitis

Blepharitis

Subacute

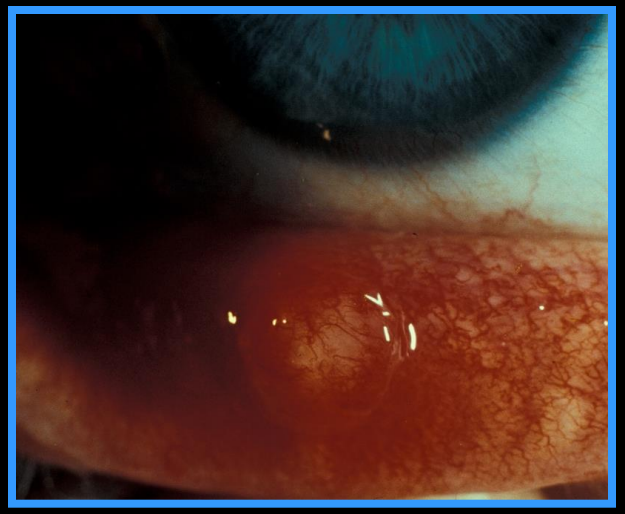
Chronic



External examination

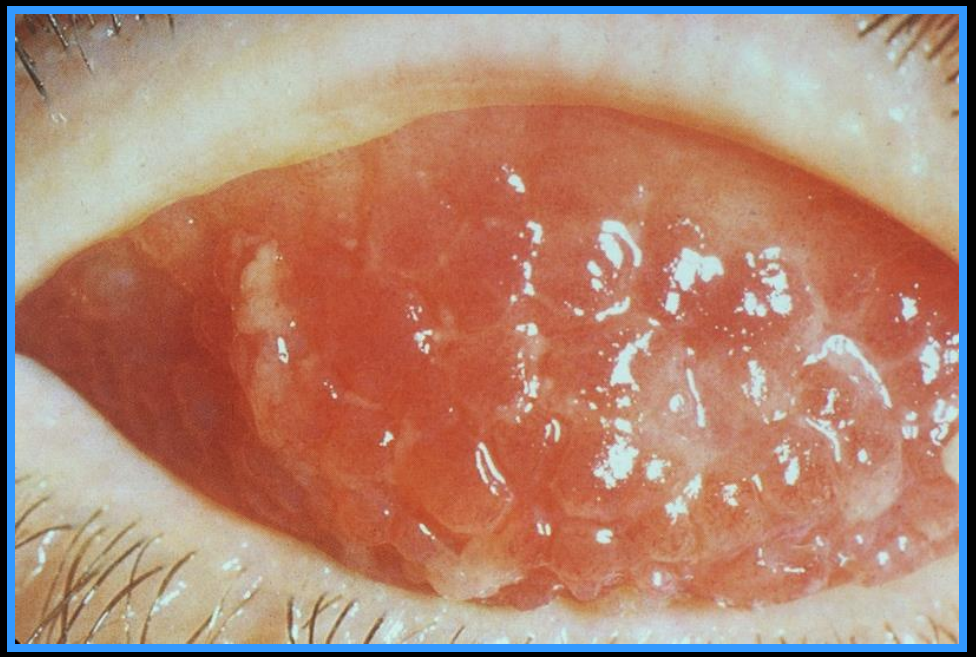
Acute blepharitis with internal hordeolum

Chalazia



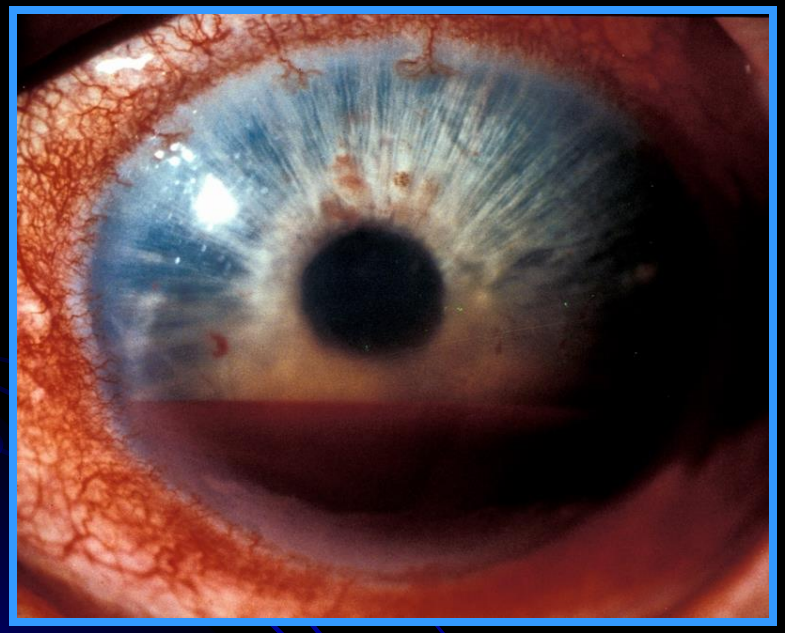
External examination

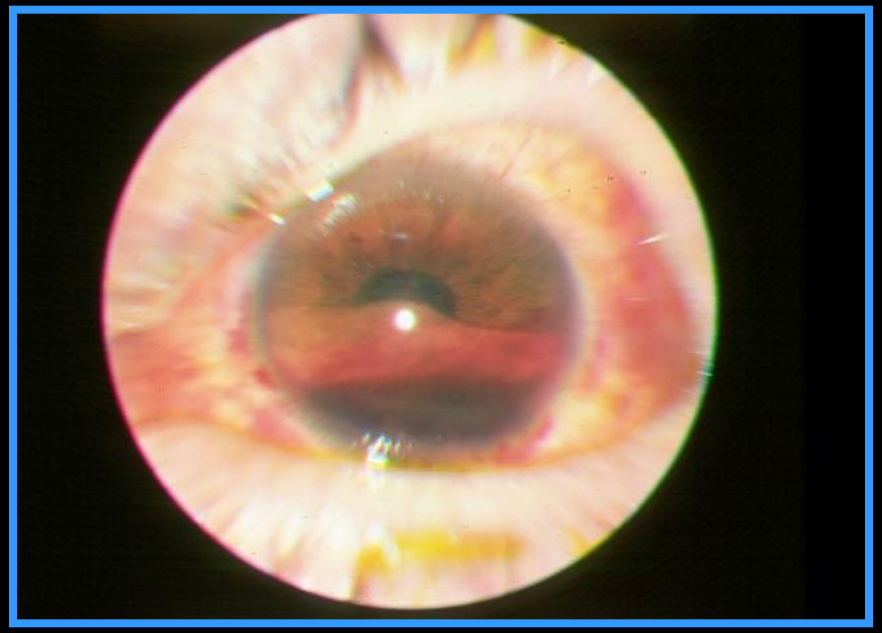
Normal tarsal conjunctiva



Cobblestone changes

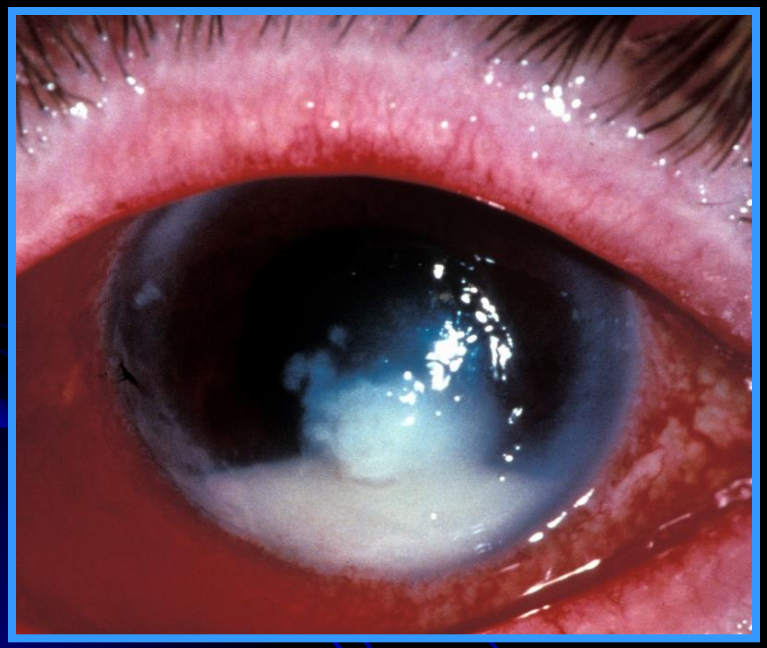
External examination





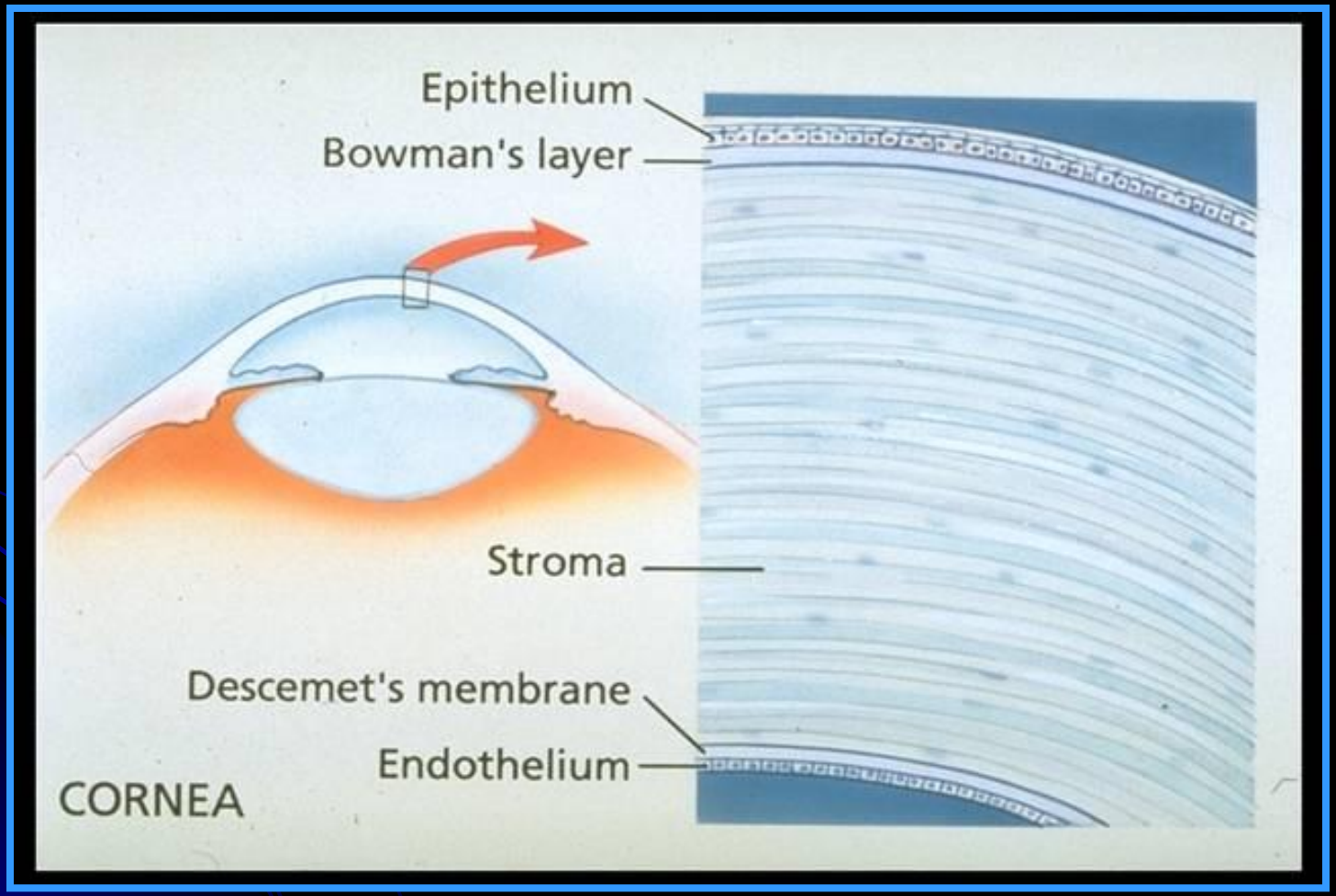
Hyphemas

External examination



Hypopyon

The cornea

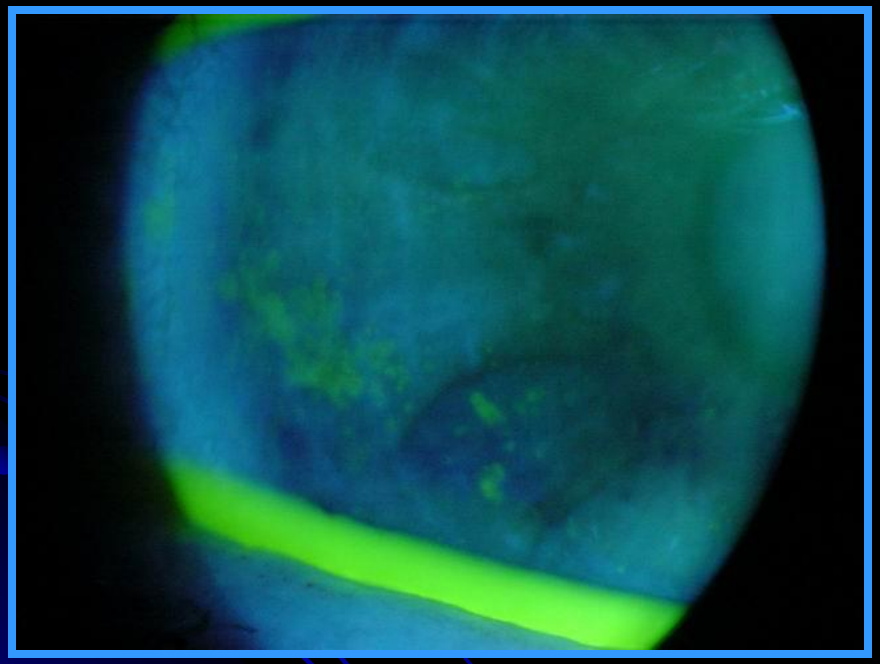

Epithelium
Bowman's layer
Stroma
Descemet's membrane
Endothelium
CORNEA

The cornea

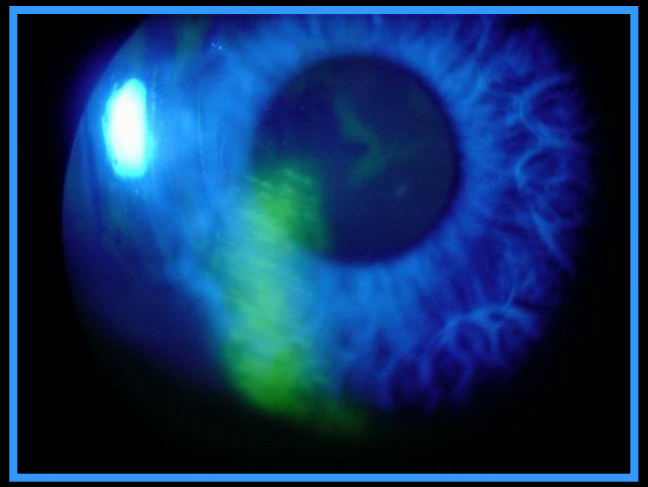
Corneal abrasions

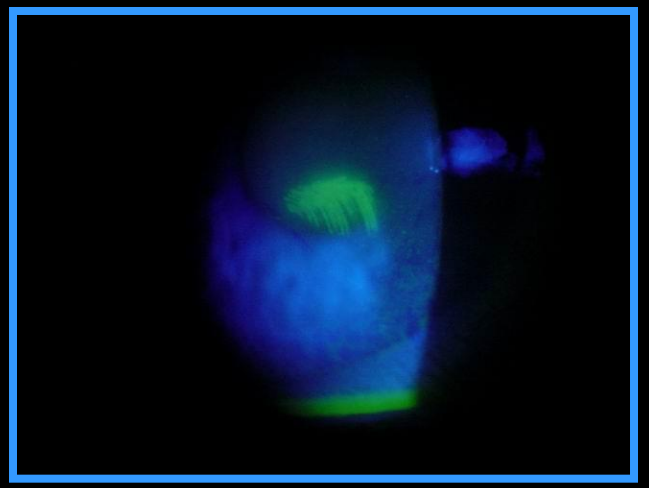
The cornea

ABRASIONS



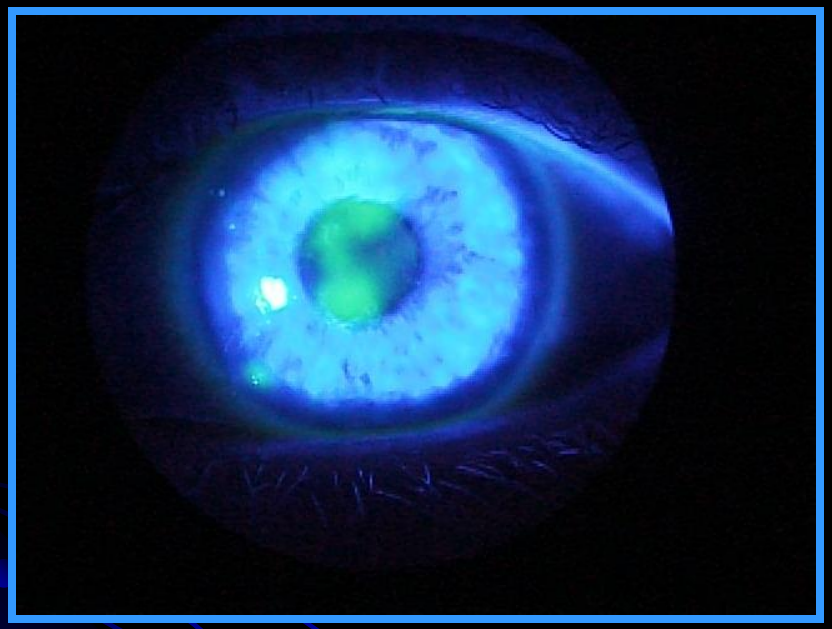
Dust storm





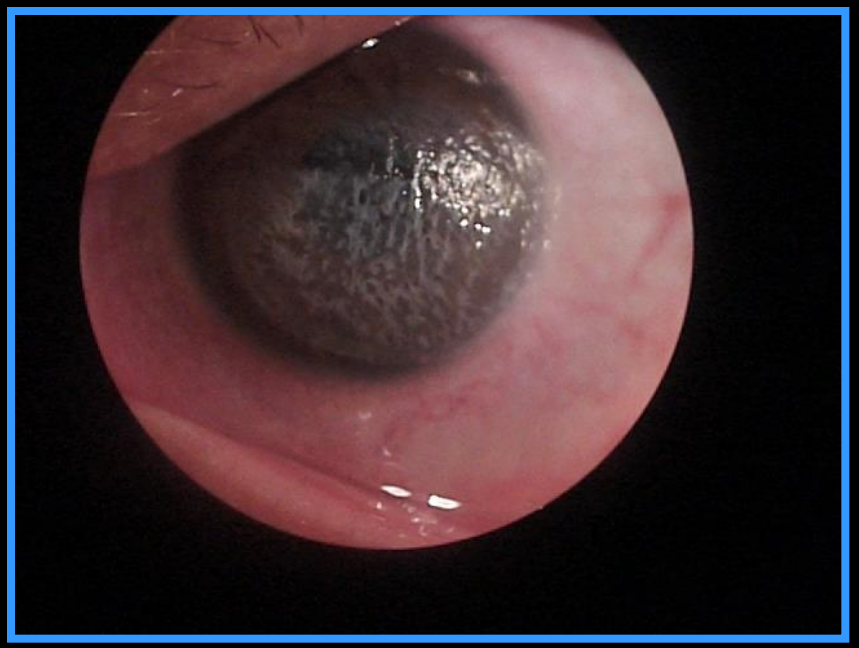
Fingernails

The cornea



Cigarette burn

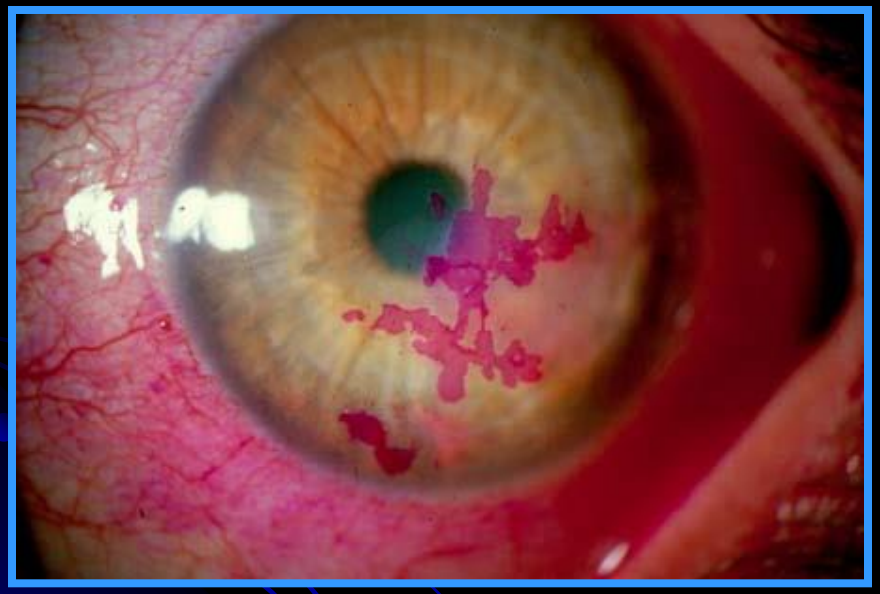
Curling iron



The cornea

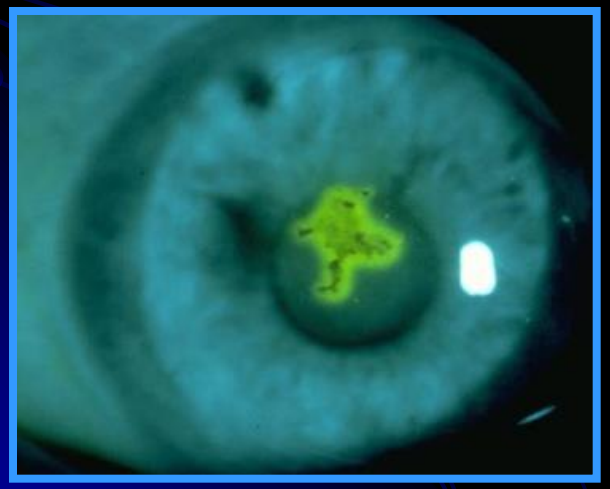
Automobile air bag abrasions

The cornea

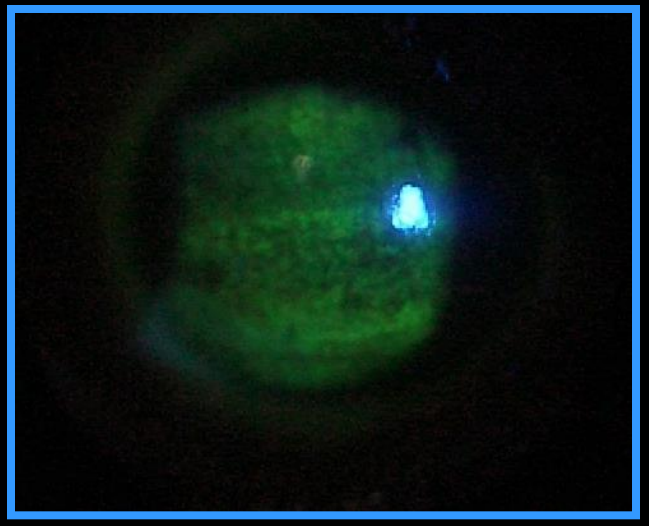


Herpes simplex I keratitis

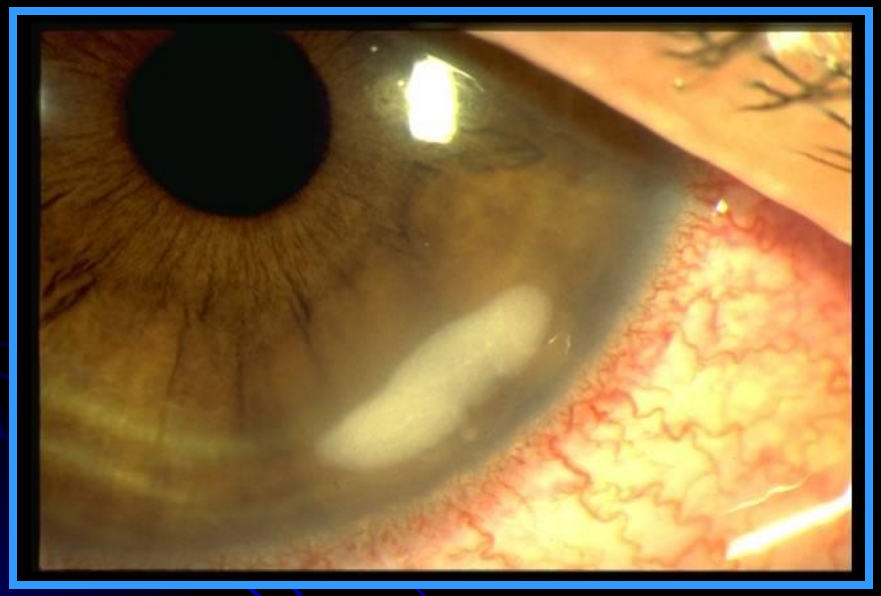
The cornea

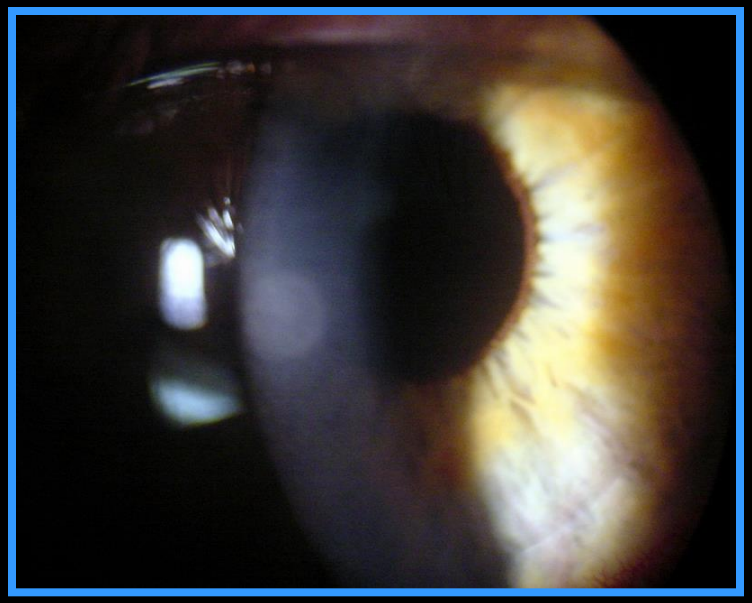


Herpes zoster



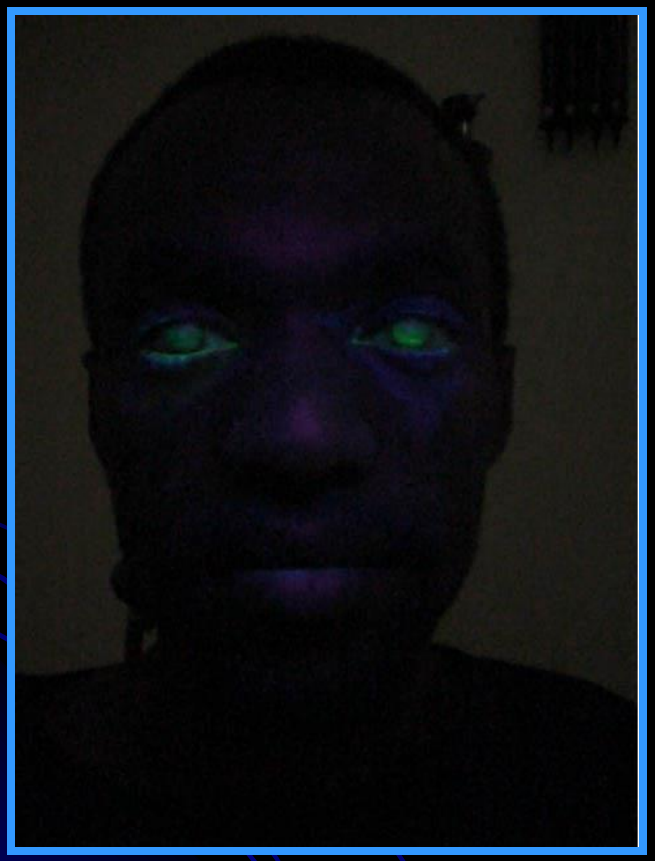
The cornea

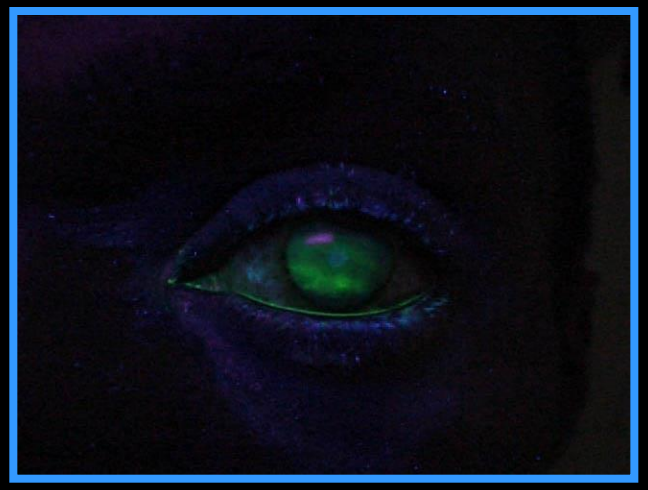


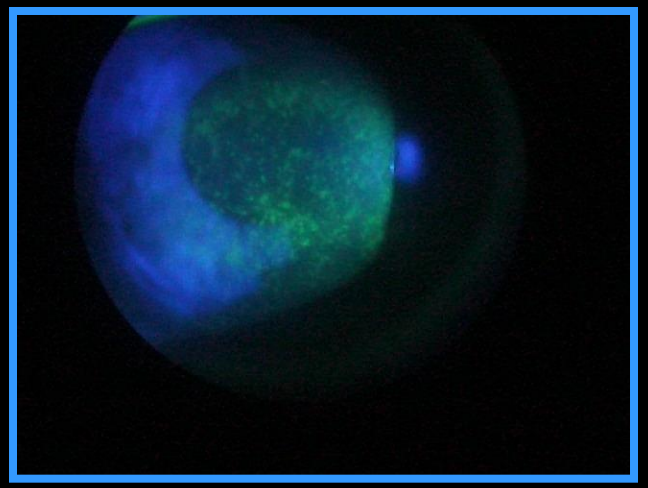


Keratitis secondary to extended wear soft contact lenses

The cornea



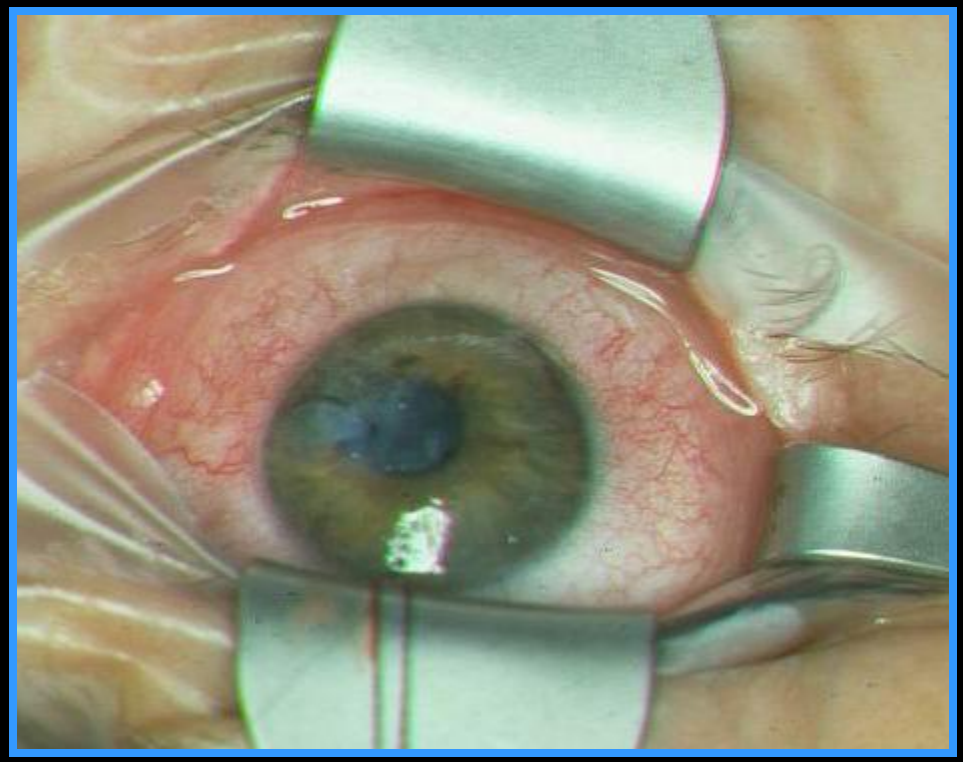




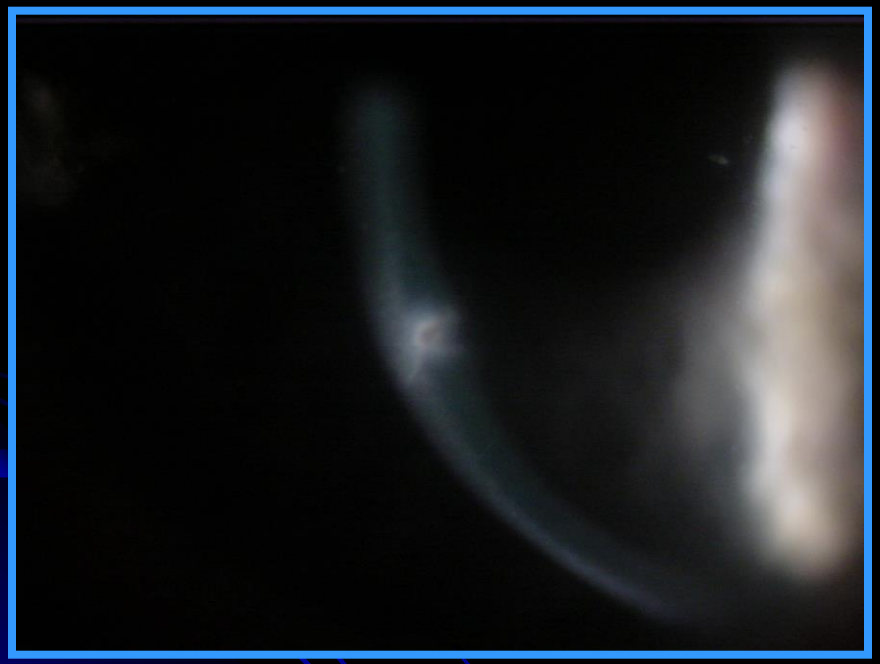
Ultraviolet keratitis

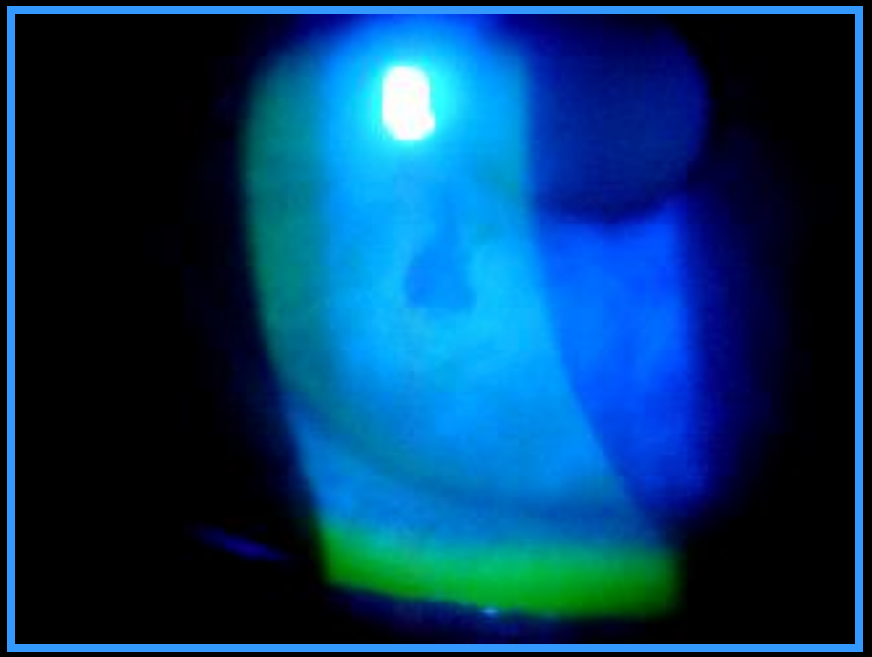
The cornea

Extensive corneal edema is your clue to a perforating injury



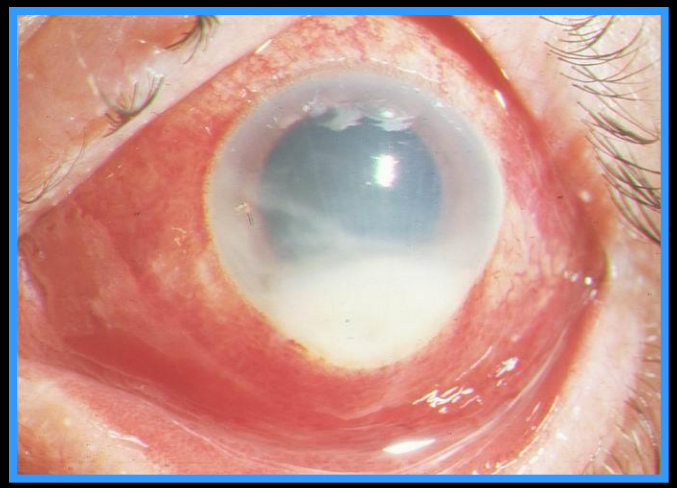
The cornea

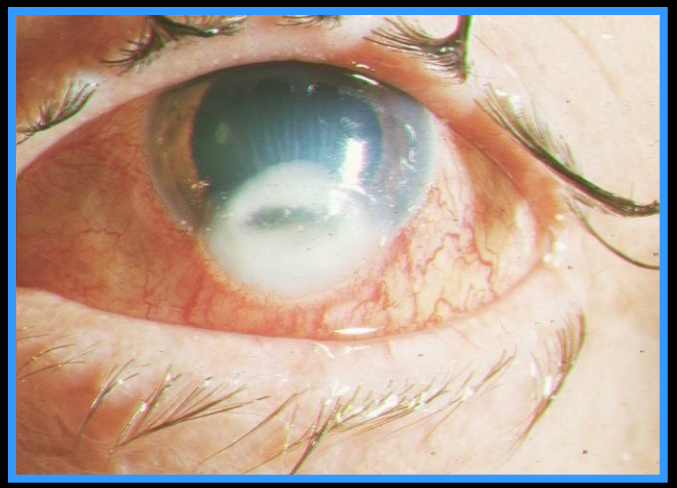


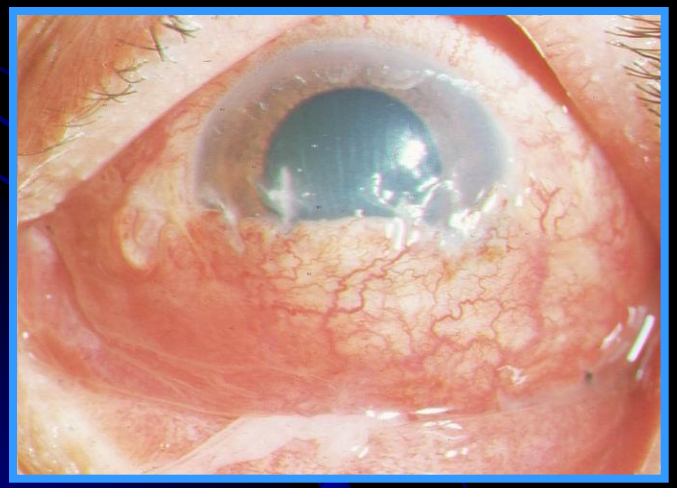


Is it perforated or not?

The cornea

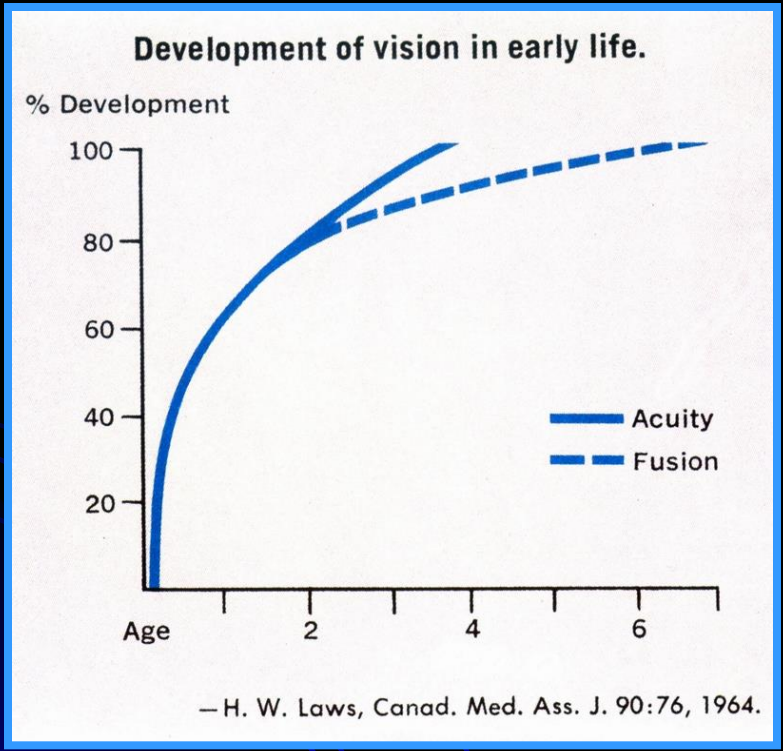






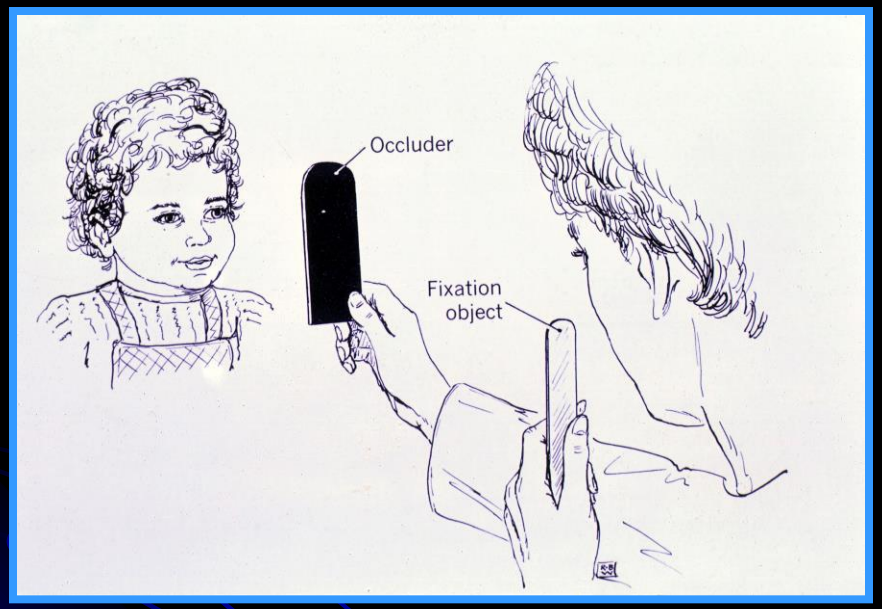
Penetrating corneal trauma with infection

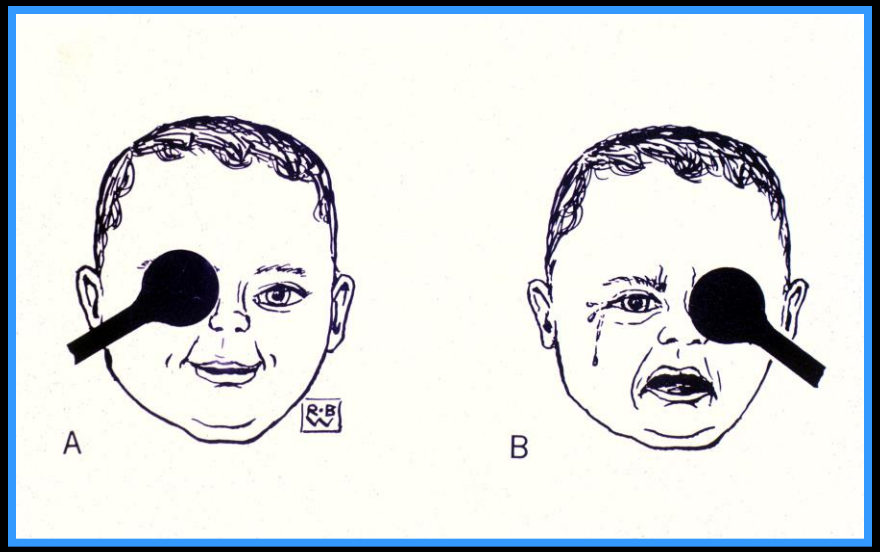
Pediatrics and motility



Measuring vision in children

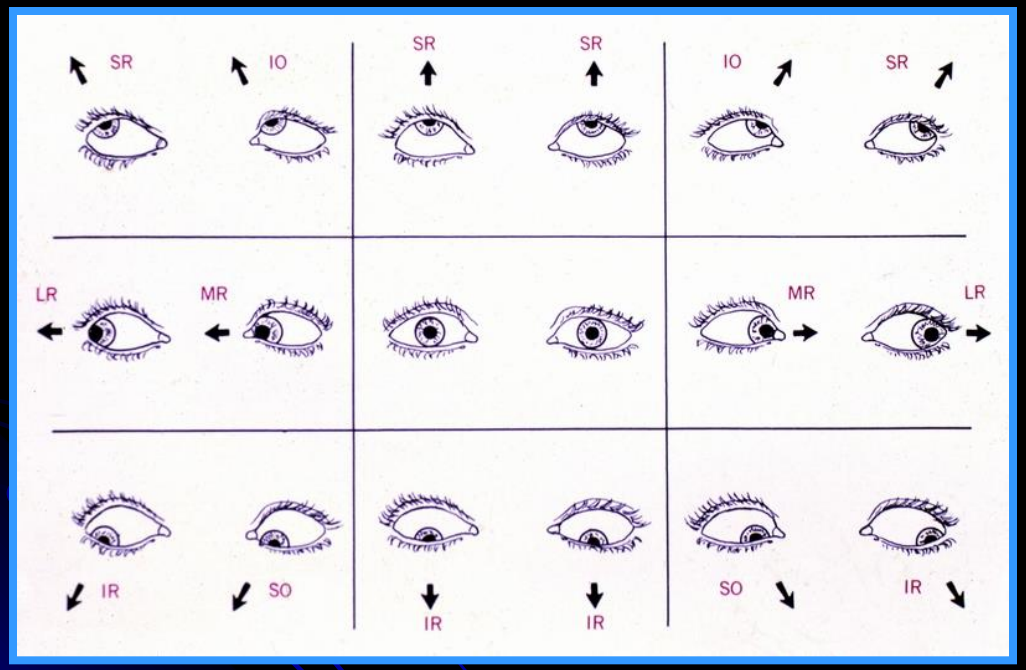
Pediatrics and motility



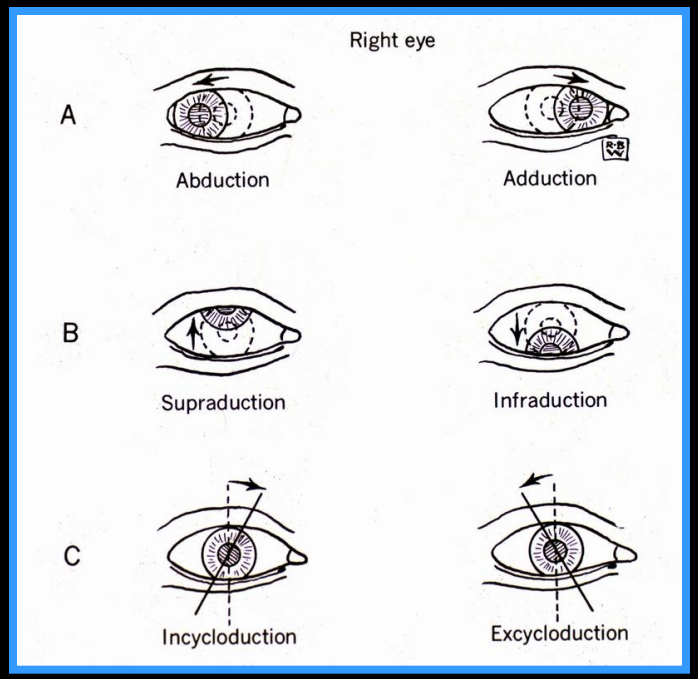


Check fixation preference in pre-verbal children

Pediatrics and motility



Versions



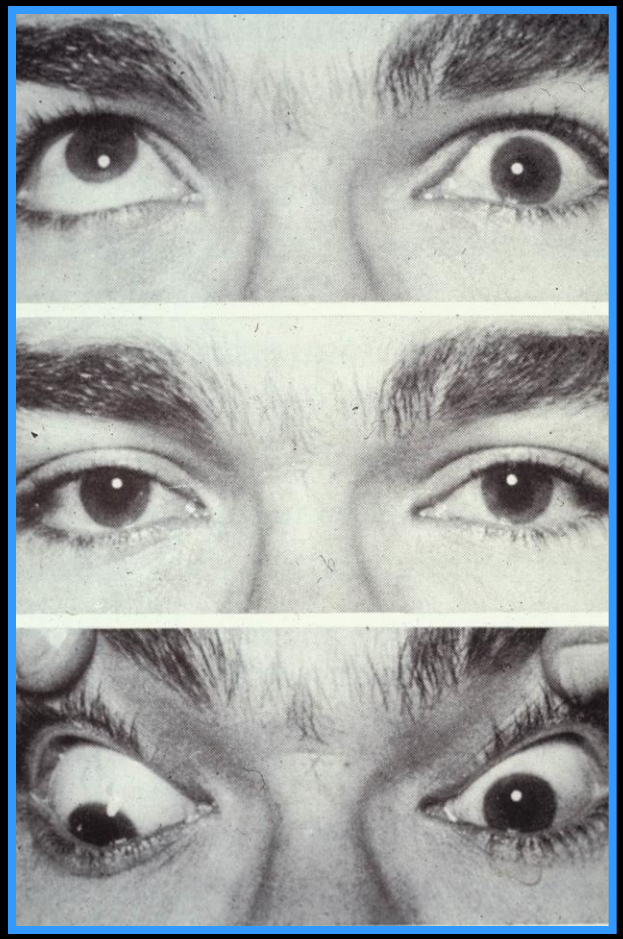
Ductions

Pediatrics and motility

Esotropia (ET)

Exotropia (XT)

?



Orbital floor fracture with trapped IR

Pediatrics and motility

Amblyopia or "lazy eye"

Definition: Poor vision in the absence of organic disease

von Graefe: "the doctor saw nothing and the patient very little"

Pediatrics and motility

Amblyopia or "lazy eye"

Etiology:

A. **Strabismus (diplopia)**
B. **Cloudy media (lack of formed images on retina)**
C. **Refractive errors (blurred vision)**

Pediatrics and motility

Amblyopia or "lazy eye"

Treatment: Amblyopia can only develop during the first 8 years of life, and can only be treated during this time!

1. Restore clear media and/or correct refractive error

2. Patch the better seeing eye and force brain to accept clear images from amblyopic eye

Ophthalmology

UNTIL NEXT TIME

GLAUCOMA

What is it?

A disease of progressive optic neuropathy with loss of retinal neurons and the nerve fiber layer, resulting in blindness if left untreated.

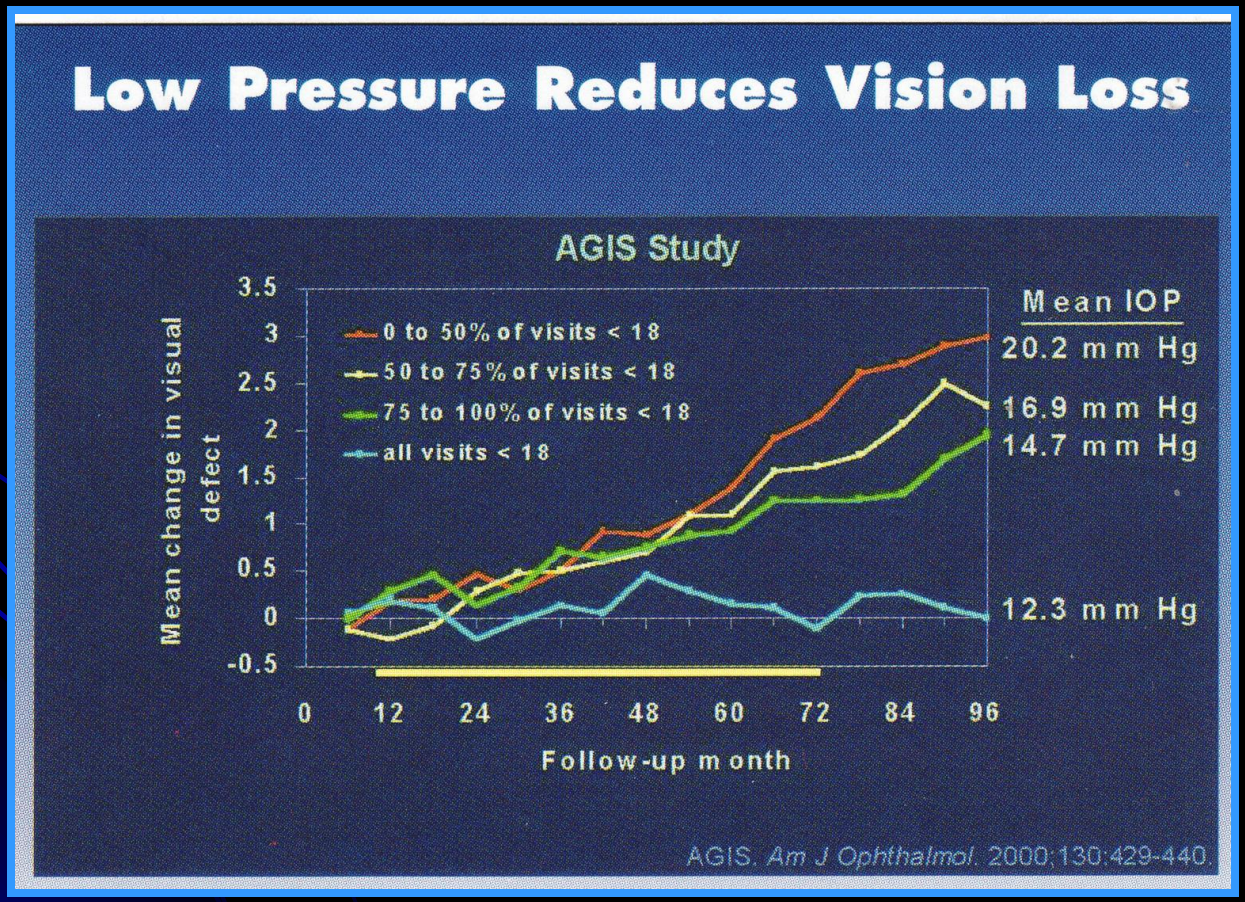
GLAUCOMA

What causes it?

There is a dose-response relationship between intraocular pressure and the risk of damage to the visual field.

GLAUCOMA

ADVANCED GLAUCOMA INTERVENTION STUDY



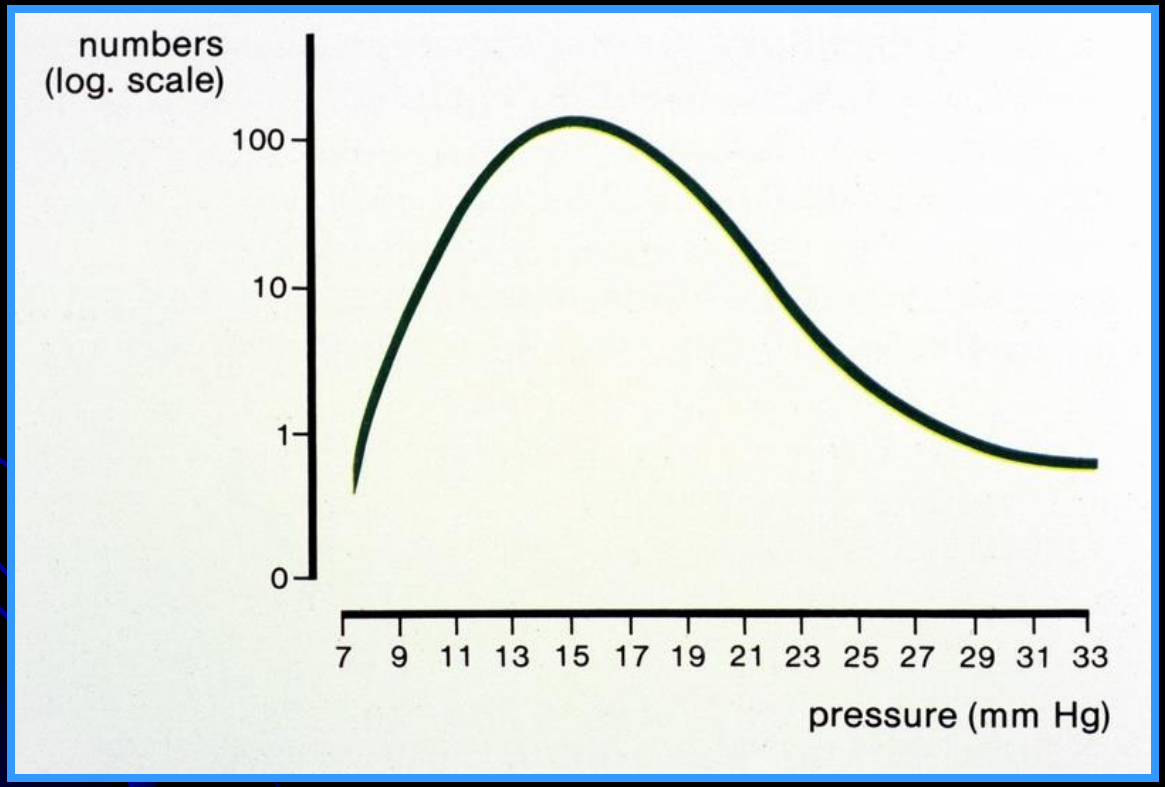
GLAUCOMA

Intraocular pressure is not the only factor responsible for glaucoma!

- **95% of people with elevated IOP will never have the damage associated with glaucoma.**
- **One-third of patients with glaucoma do not have elevated IOP.**
- **Most of the ocular findings that occur in people with glaucoma also occur in people without glaucoma.**

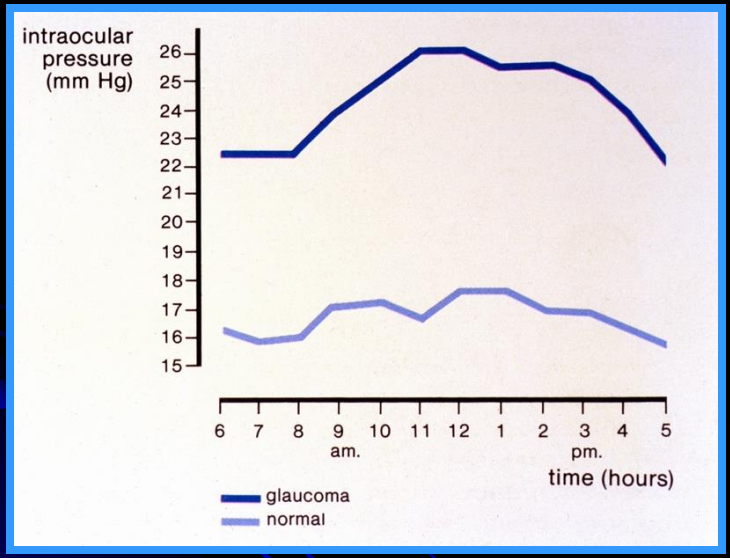
GLAUCOMA

Population distribution of intraocular pressure



GLAUCOMA

Some characteristics of IOP

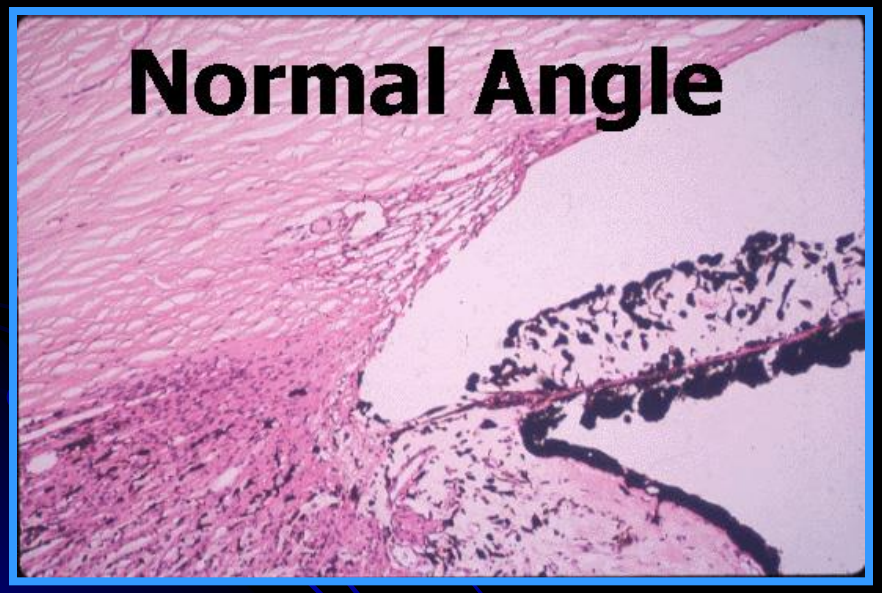


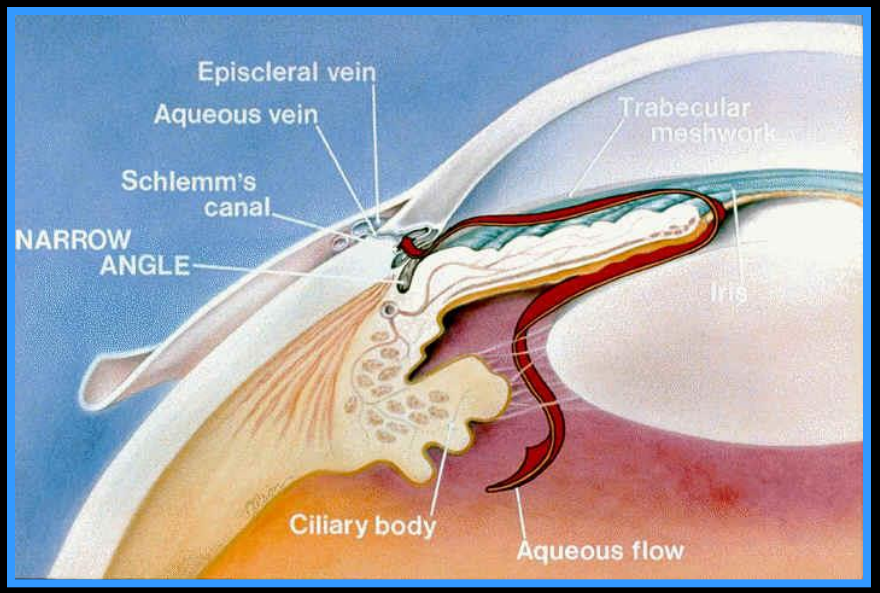
Normal vs glaucoma

Effects of age and sex

GLAUCOMA

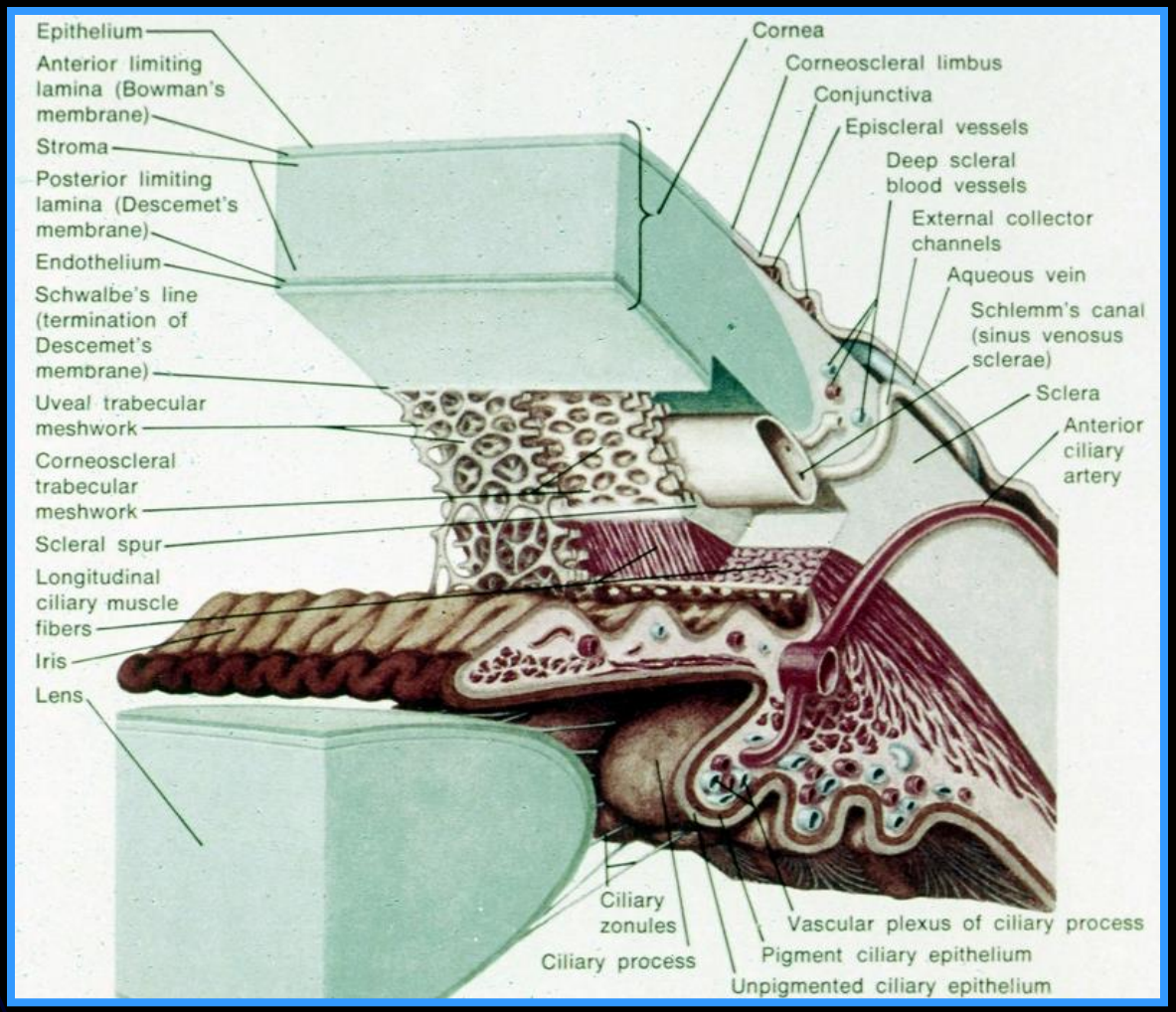
Angle Anatomy





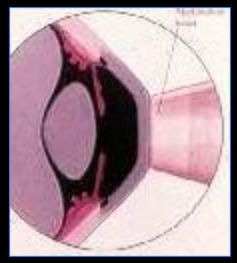
GLAUCOMA

Anatomy of anterior chamber angle

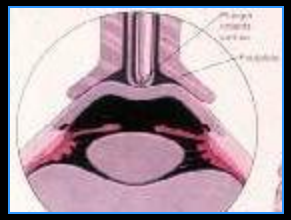


GLAUCOMA

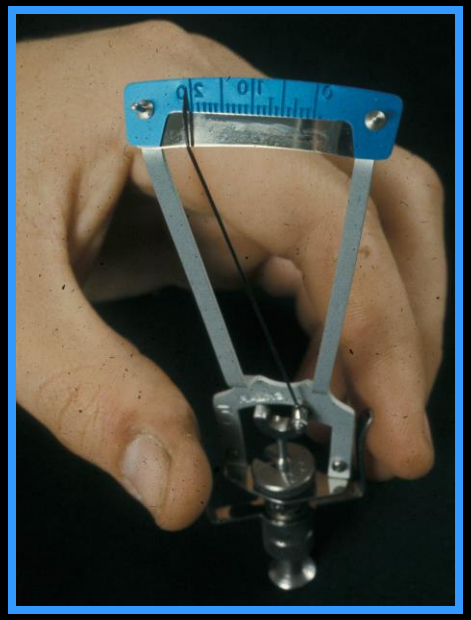
How do we measure IOP?



Applanation



Schiotz



GLAUCOMA

Ocular hypertension treatment study (OHTS study)

- **GOALS: To evaluate the effectiveness of topical ocular hypotensive medications in preventing or delaying visual field loss and/or optic nerve damage in subjects with ocular hypertension at moderate risk for developing open-angle glaucoma (POAG).**

- **POPULATION: 1636 participants aged 40-80 years with IOP 24-32 mm HG in one eye, and 21-32 in the other, randomly assigned to observation and treatment groups.**

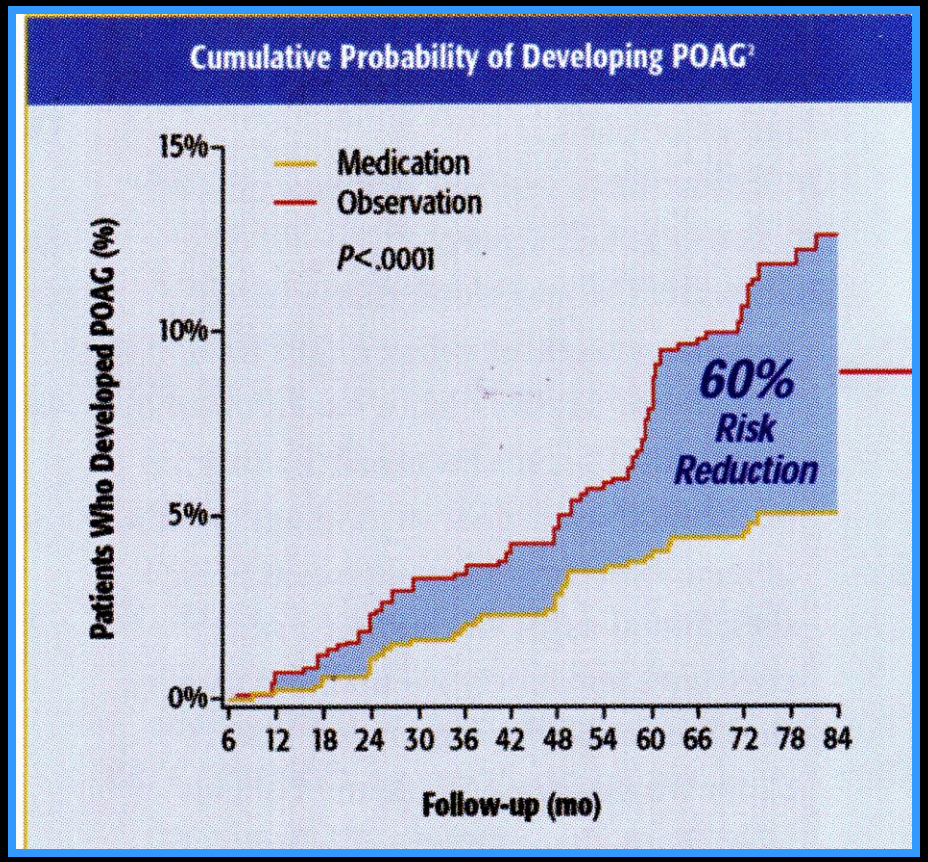
GLAUCOMA

OHTS Conclusions

At 60 months, the probability of developing glaucoma was:

9.5% in observation group

4.4% in treatment group



GLAUCOMA

OHTS parameters that influence the risk of developing POAG

- Age
- Cup-disk ratio
- Central corneal thickness
- IOP

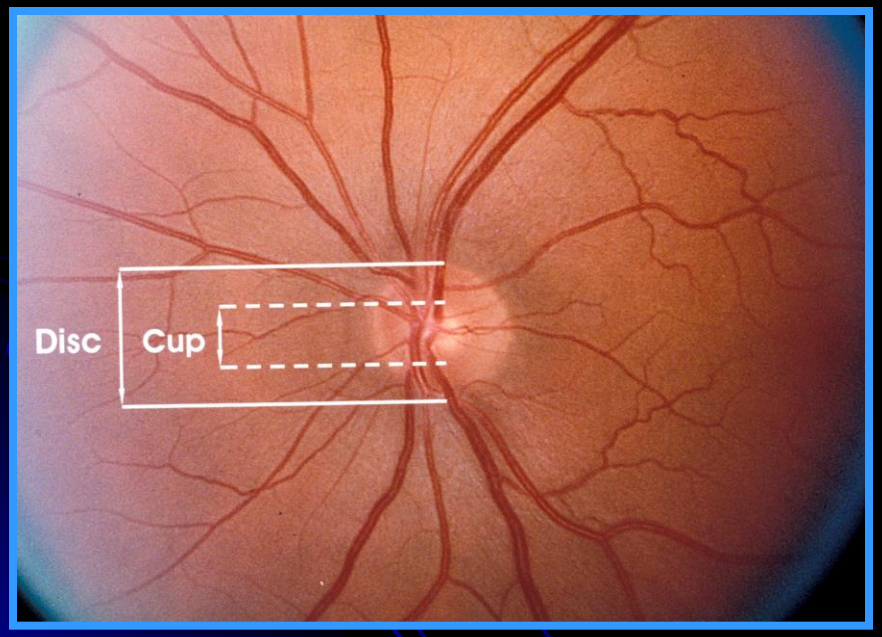
GLAUCOMA

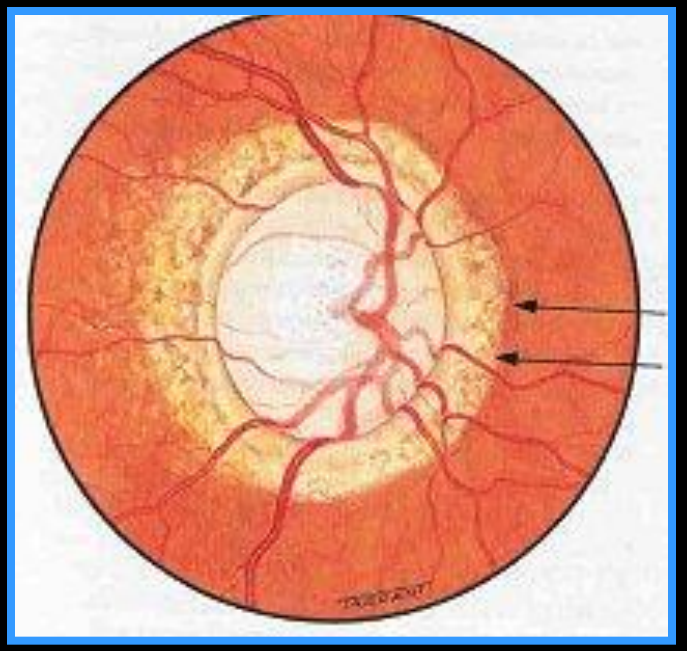
Optic nerve signs of glaucoma progression

- Increasing C:D ratio
- Development of disk pallor
- Disc hemorrhage (60% will show progression of visual field damage)
- Vessel displacement
- Increased visibility of lamina cribosa

GLAUCOMA

Cup-to-disk ratio

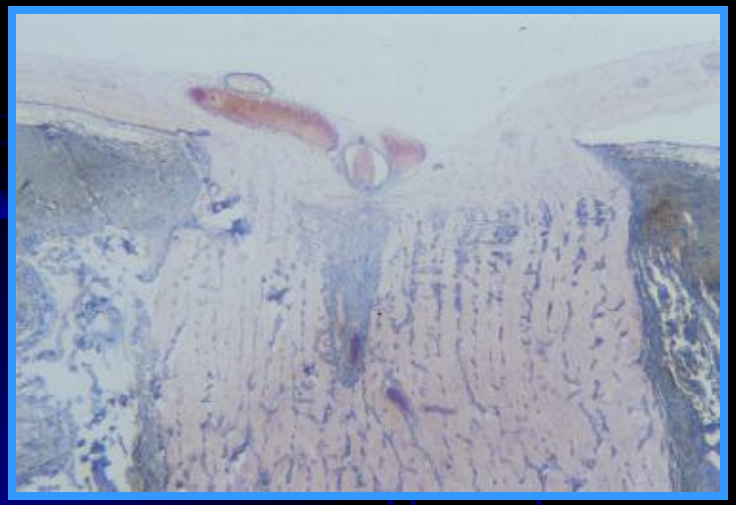




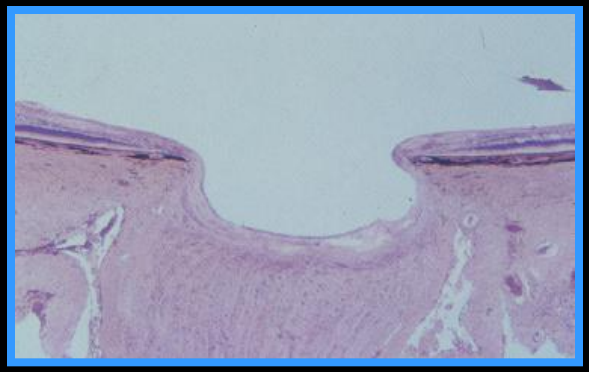
GLAUCOMA

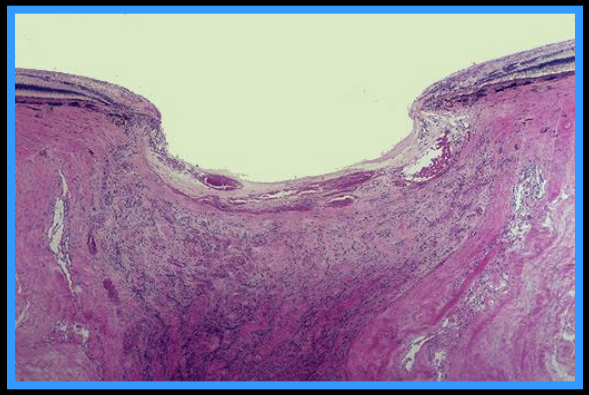
The histology of glaucomatous optic nerve cupping:

Normal:



Glaucomatous:





GLAUCOMA

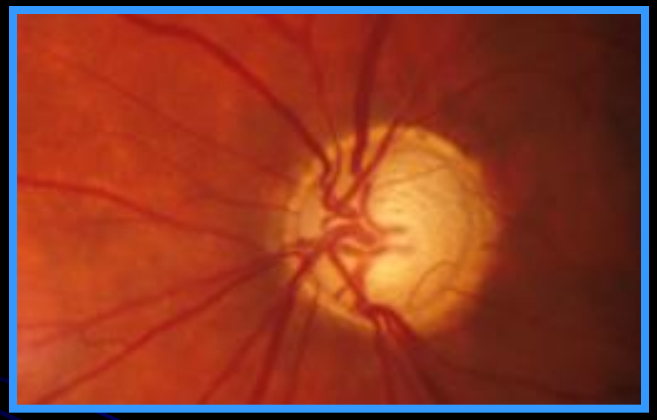
DISK CUPPING

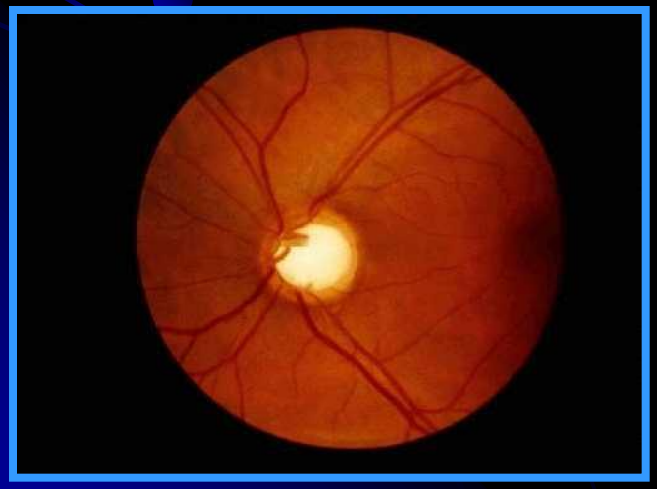
Normal

Glaucoma

GLAUCOMA

Glaucomatous cupping





GLAUCOMA

Types of glaucoma

I. Primary:
- A. Congenital
- B. Juvenile (hereditary)
- C. Adult
  - 1. Narrow angle
  - 2. Open angle

II. Secondary
- A. Inflammatory
- B. Traumatic
- C. Rubeotic
- D. Phacolytic
- etc.

Congenital Glaucoma

Onset: antenatally to 2 years old

Symptoms

- Irritability
- Photophobia
- Epiphora
- Poor vision

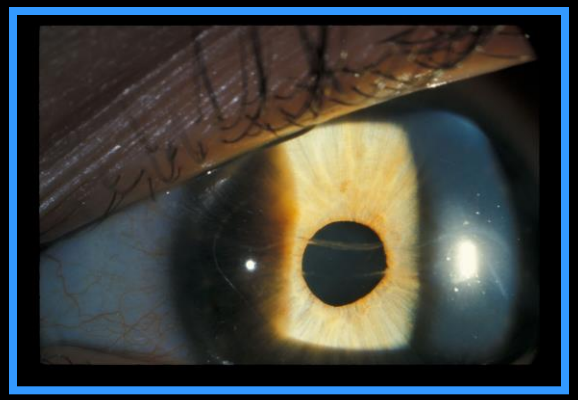
Signs

- Elevated IOP
- Buphthalmos
- Haab's striae
- Corneal clouding
- Glaucomatous cupping
- Field loss

Congenital Glaucoma

Buphthalmos, glaucomatous cupping, and cloudy cornea OD

Normal OS



Haab's striae

Congenital Glaucoma

Buphthalmos and cloudy corneas

Narrow Angle Glaucoma

Onset: 50+ years of age

Symptoms

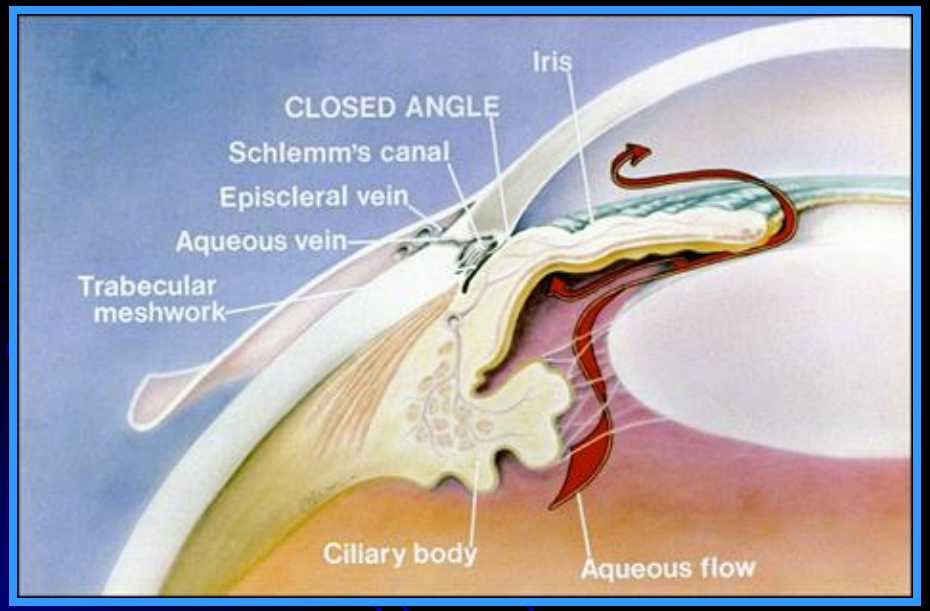
- Severe eye/headache pain
- Blurred vision
- Red eye
- Nausea and vomiting
- Halos around lights
- Intermittent eye ache at night

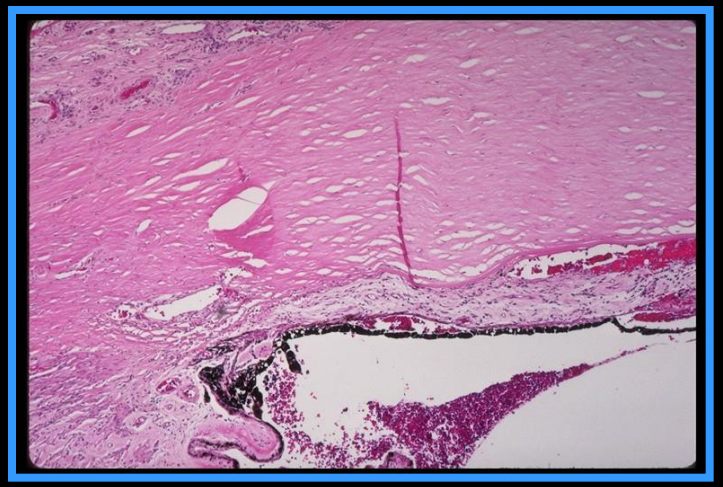
Signs

- Red, teary eye
- Corneal edema
- Closed angle
- Shallow AC
- Mid-dilated, fixed pupil
- “Glaucomflecken”
- Iris atrophy
- AC inflammation

GLAUCOMA

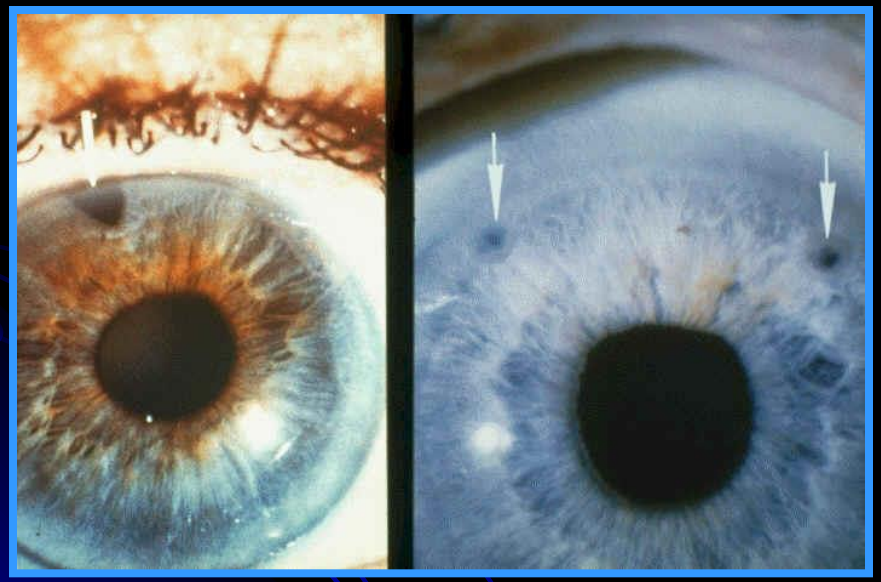
Anatomy of Angle Closure Glaucoma

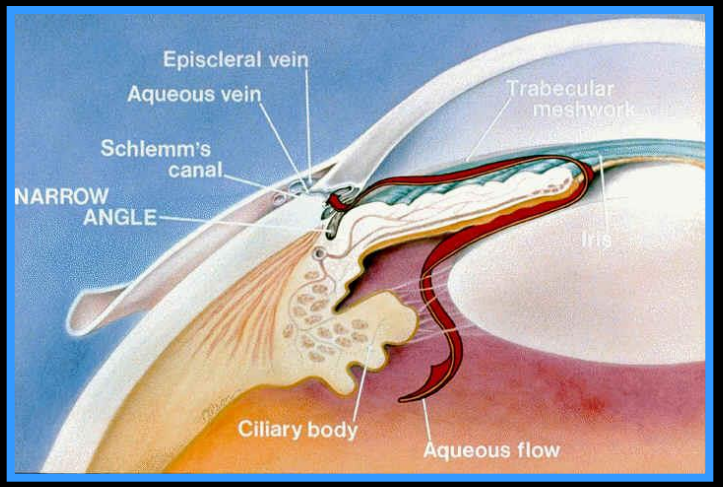


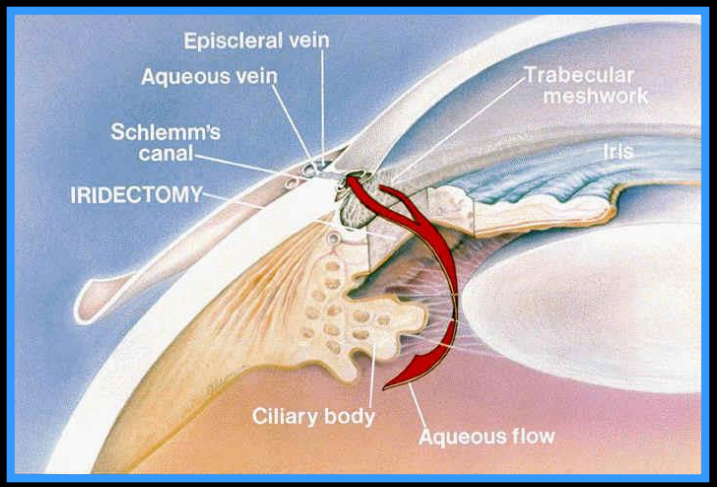


Narrow Angle Glaucoma

Treatment: Peripheral iridotomy







Narrow Angle Glaucoma

Acute angle-closure attack!

Red eye, cloudy cornea, and mid-dilated non-reactive pupil

Open Angle Glaucoma

Aka: chronic simple glaucoma (CSG)

and primary open angle glaucoma (POAG)

Onset: 50+ years of age

Symptoms

- Usually none
- May have loss of central and peripheral vision late

Signs

- Elevated IOP
- Visual field loss
- Glaucomatous disk changes

GLAUCOMA

Treatment

Medical

- Miotics
- Beta-blockers
- Carbonic anhydrase inhibitors
- Prostaglandin analogues
- Alpha-2 agonists

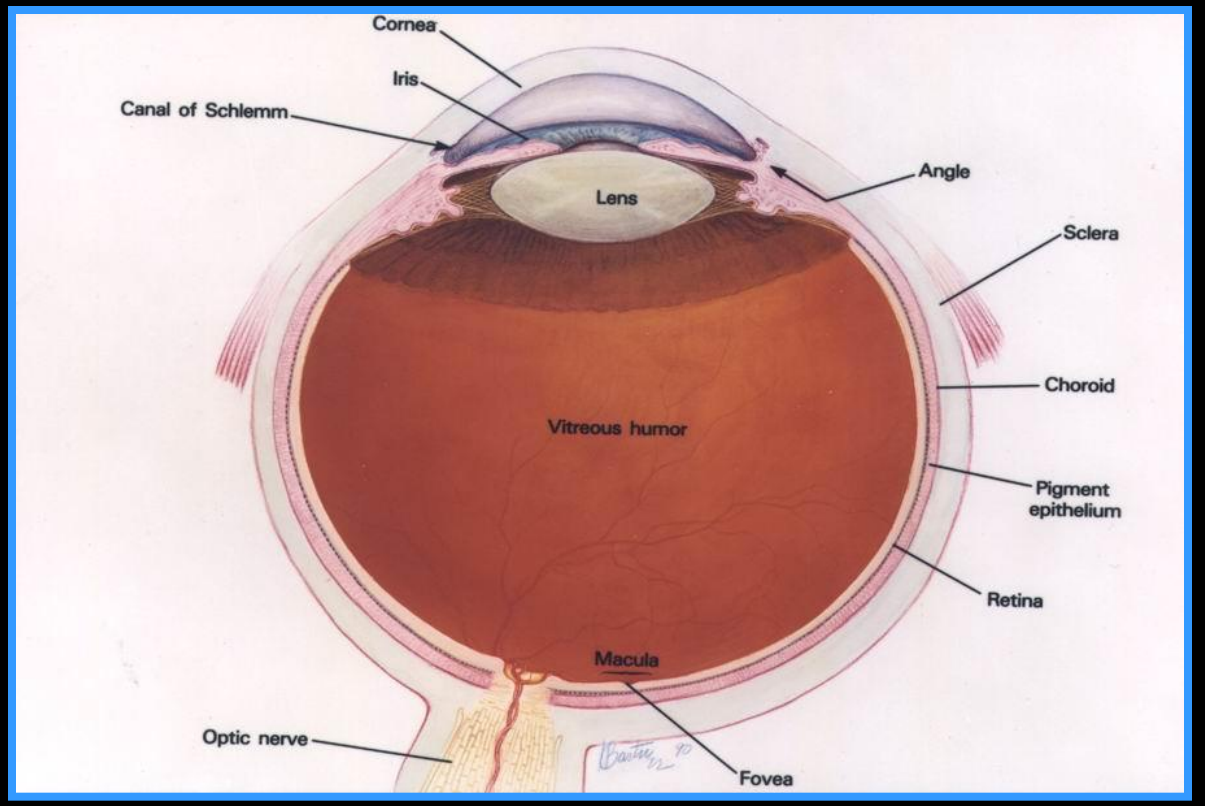
Surgical

- Argon laser trabeculoplasty
- Trabeculectomy
- Filtering procedure
- Cyclocryotherapy
- Cyclolaser ablation
- Iridotomy

The posterior segment

Structures:

I. Optic nerve
II. Vitreous
III. Retina and vasculature
IV. Macula
V. Choroid and vasculature
VI. Lens
VII. Ciliary body and zonule
VIII. Pars plana & plicata



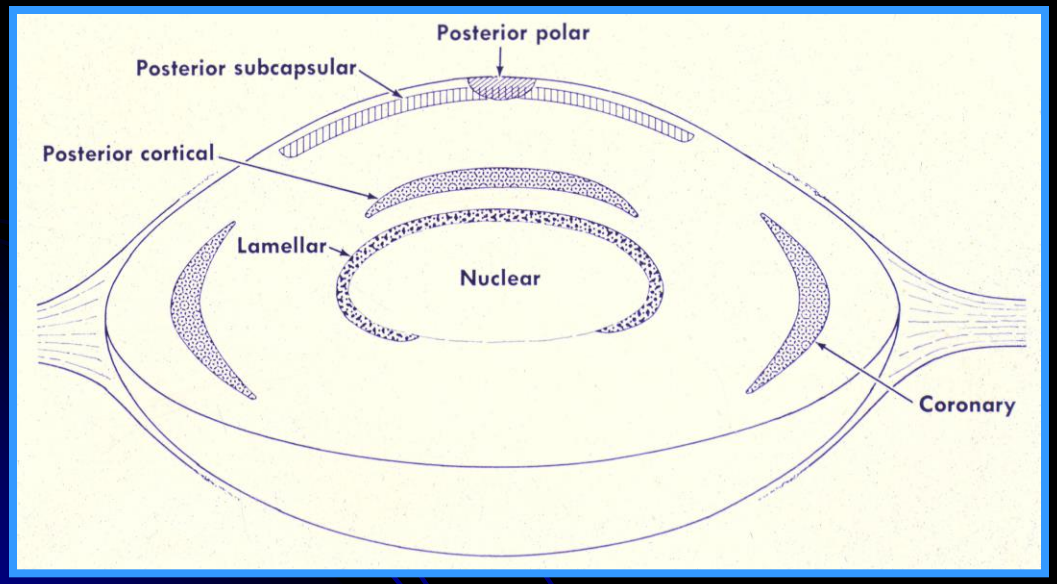
The posterior segment

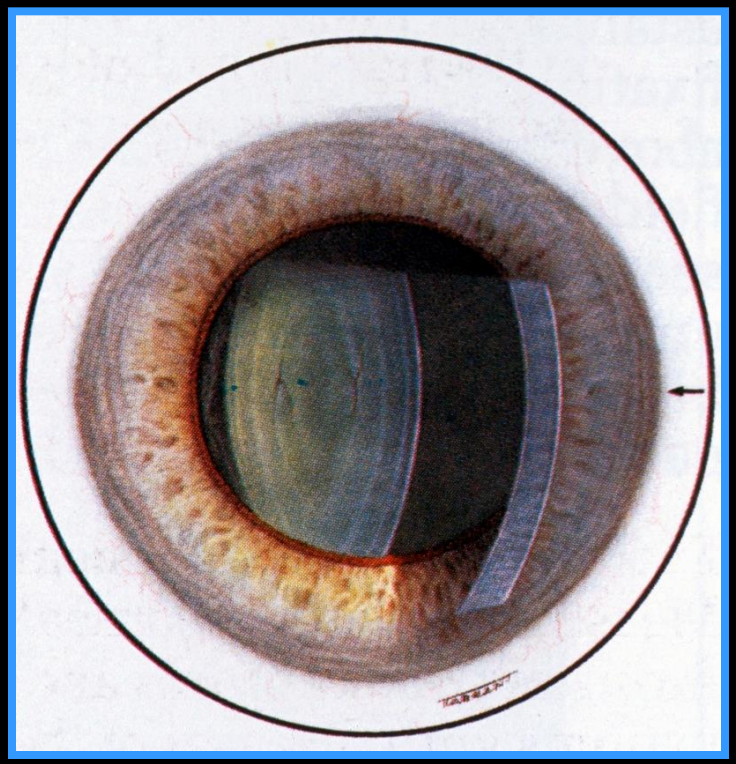
Evaluation techniques:

I. Direct ophthalmoscopy
II. Indirect ophthalmoscopy
III. Slit lamp and lenses
IV. Ultrasound (A & B)
V. Electroretinogram (ERG)
VI. Electrooculogram (EOG)
VII. Magnetic resonance imaging
VIII. Fluorescein angiogram
IX. Visual fields

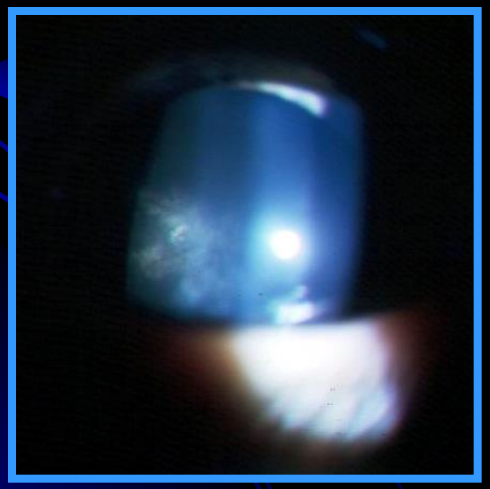
The lens

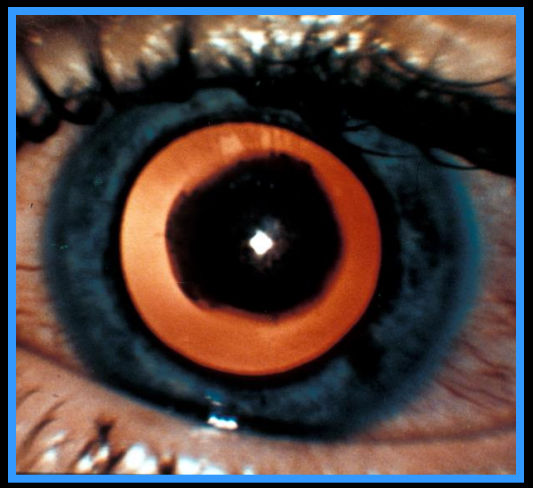
Morphology

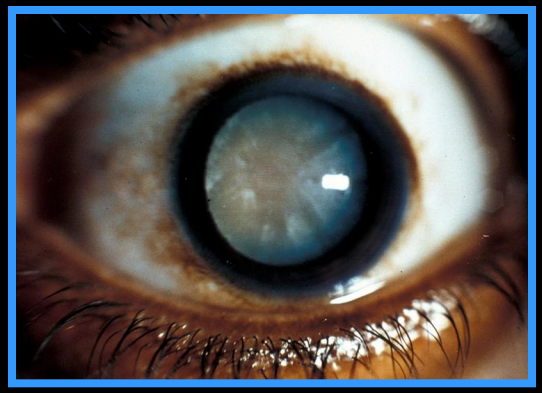




Cataracts

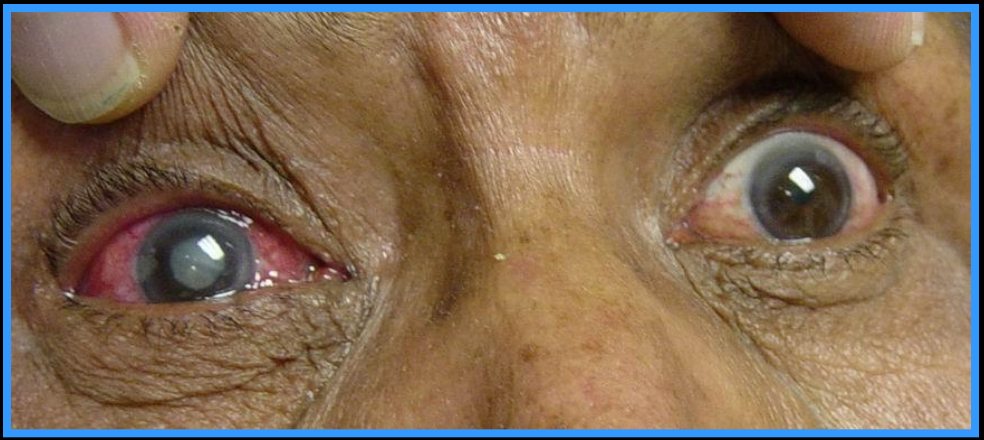






Cataract

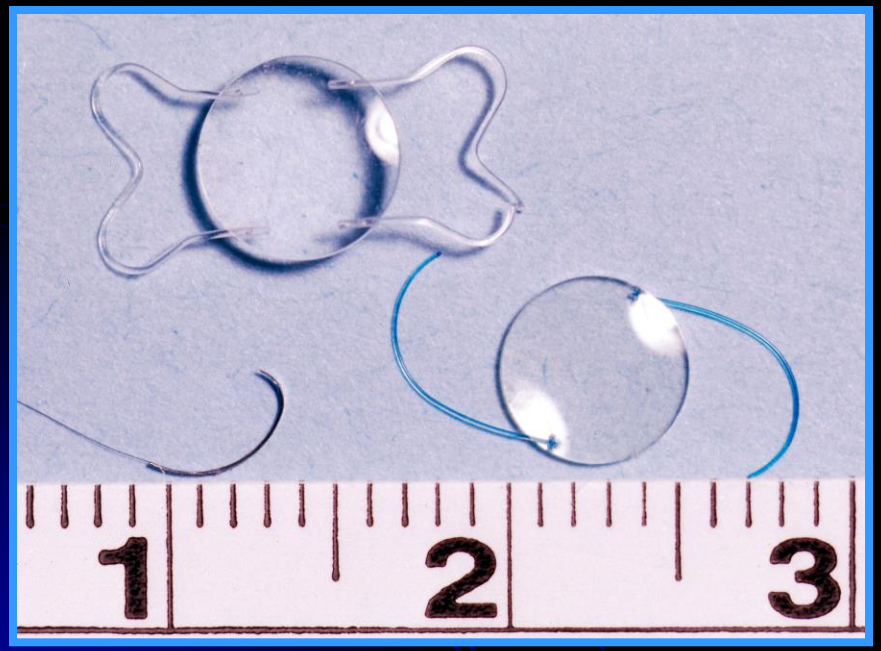
Advanced cataract

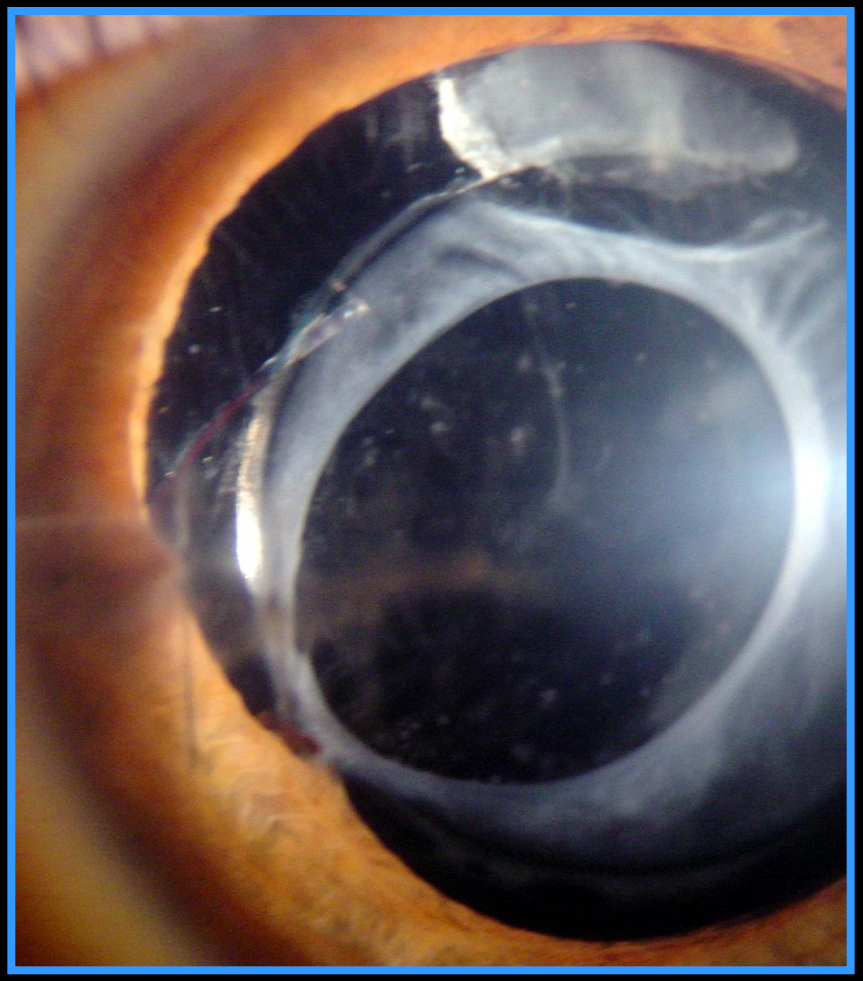


Phacolytic glaucoma

Cataract

Surgery



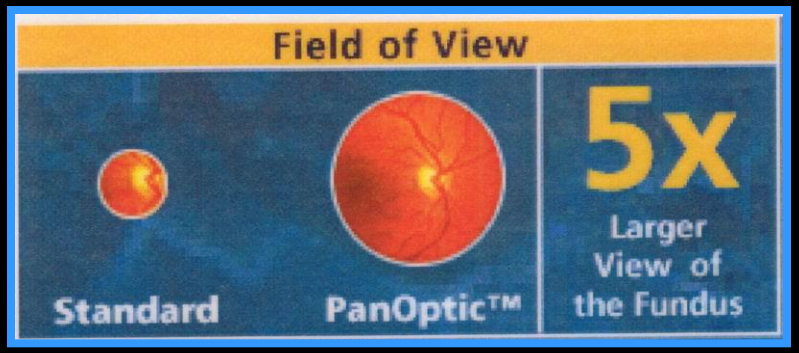


Ophthalmology

Ophthalmoscopy

Monocular examination:

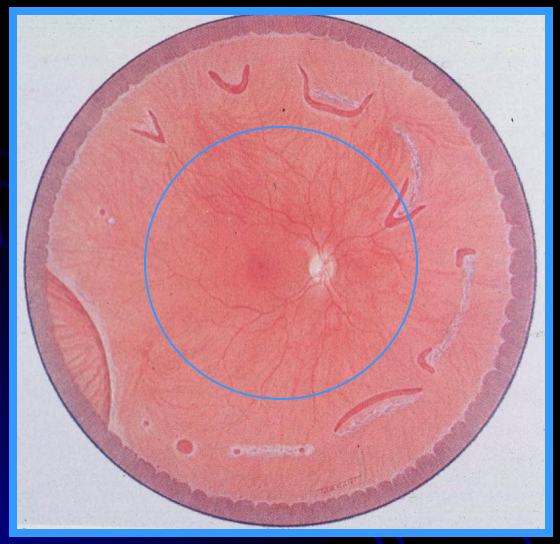
WA conventional head

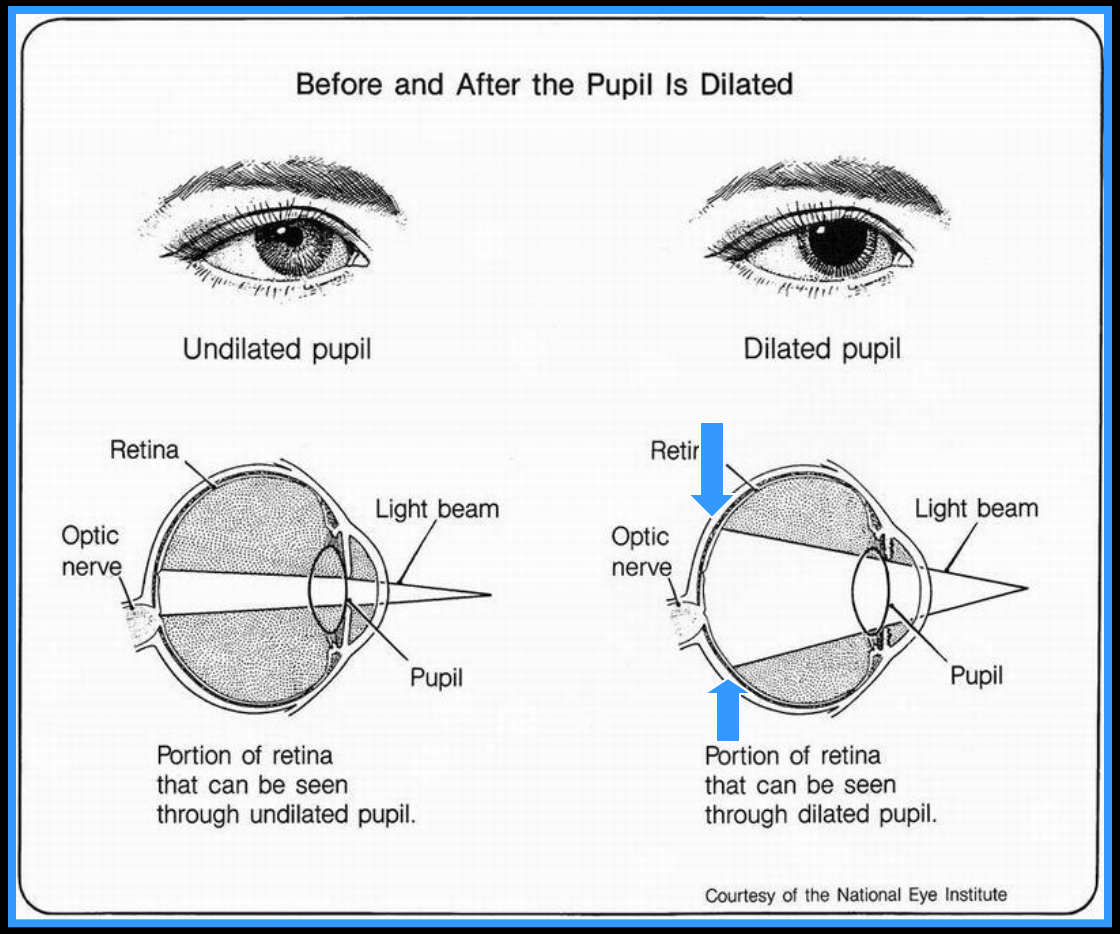


WA Panoptic head

Retinal examination

To dilate or not to dilate:

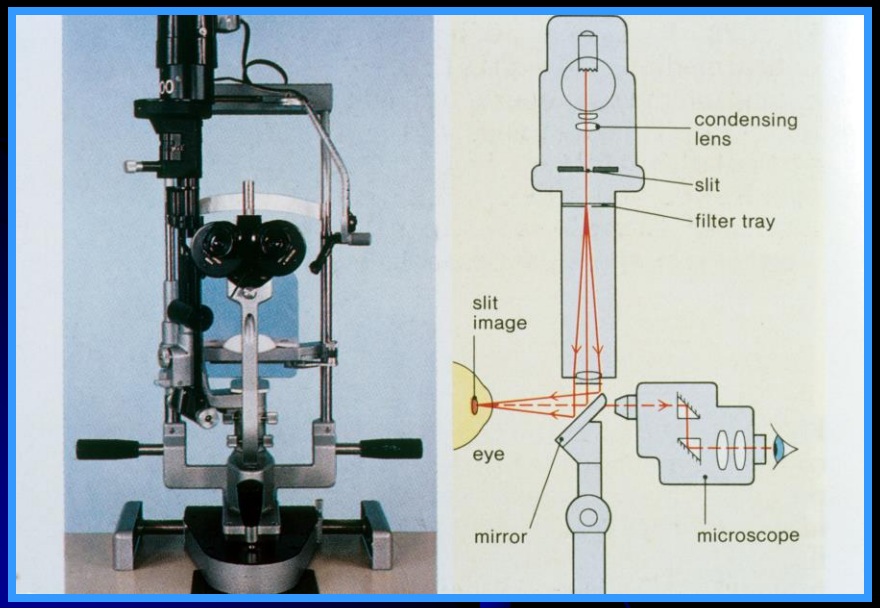




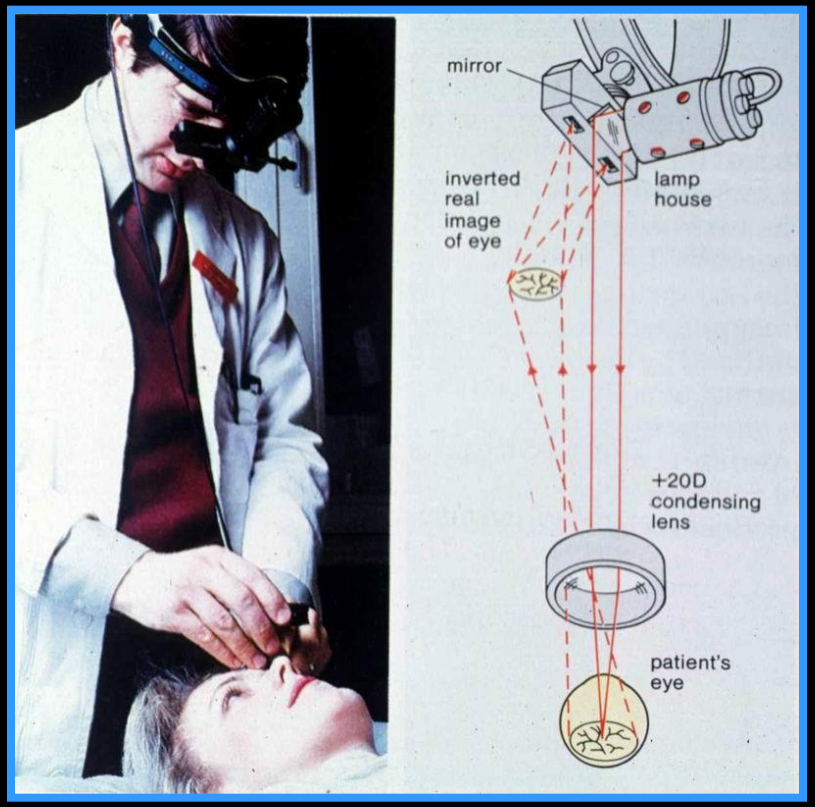
Ophthalmoscopy

Binocular examination:

Slit lamp

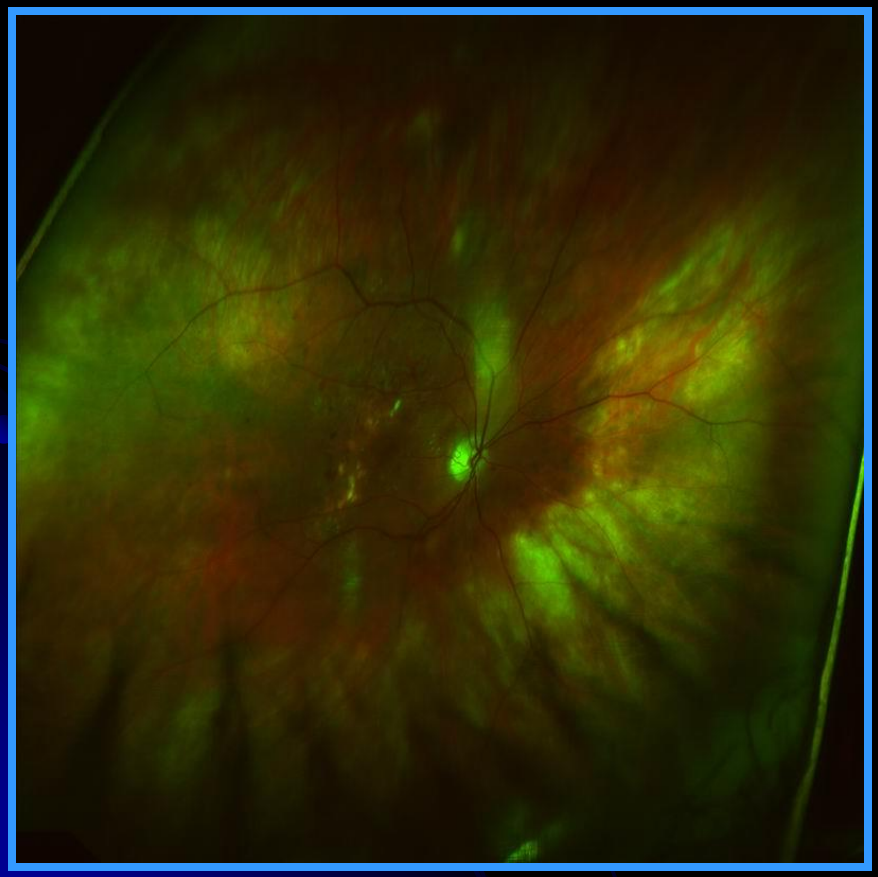


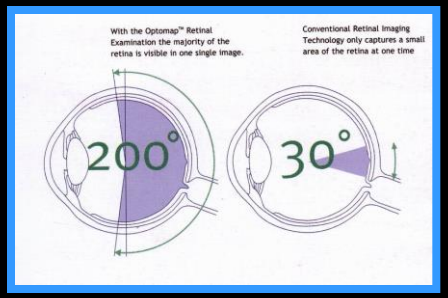
Indirect ophthalmoscopy

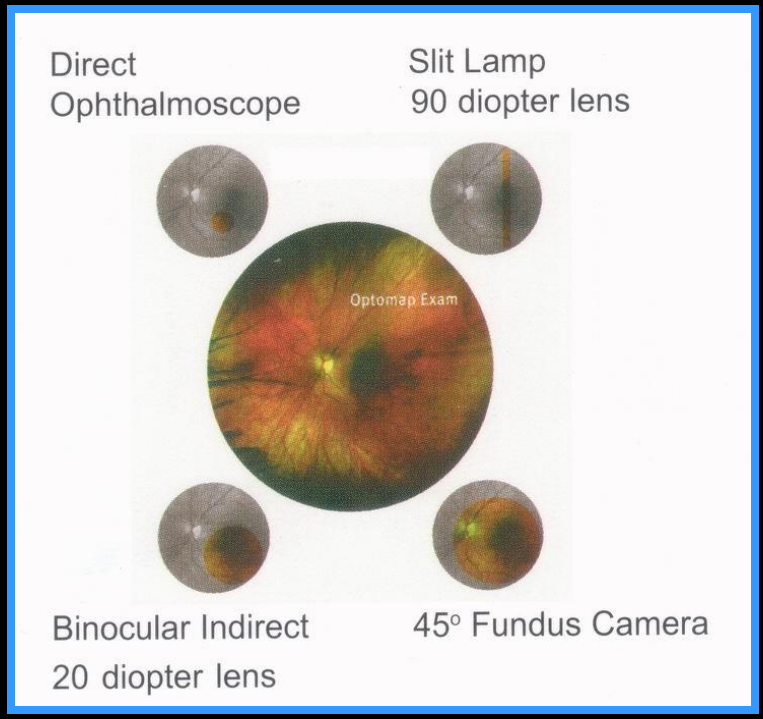


Ophthalmoscopy

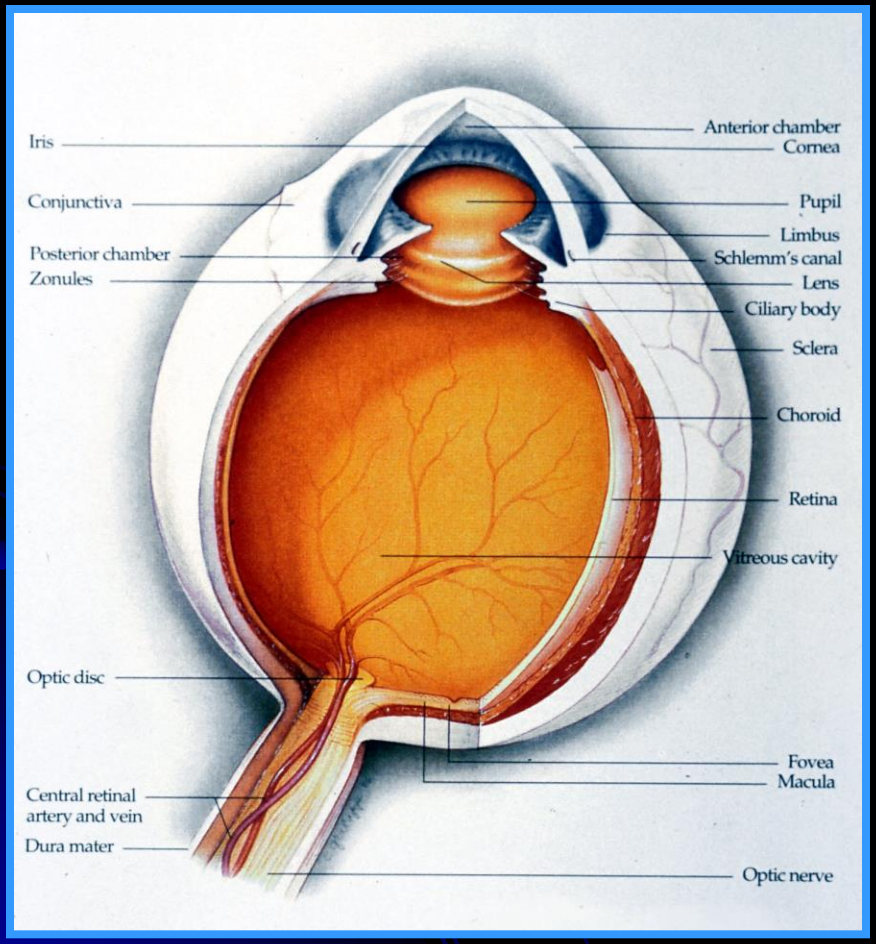
The future?







The ocular fundus



The ocular fundus

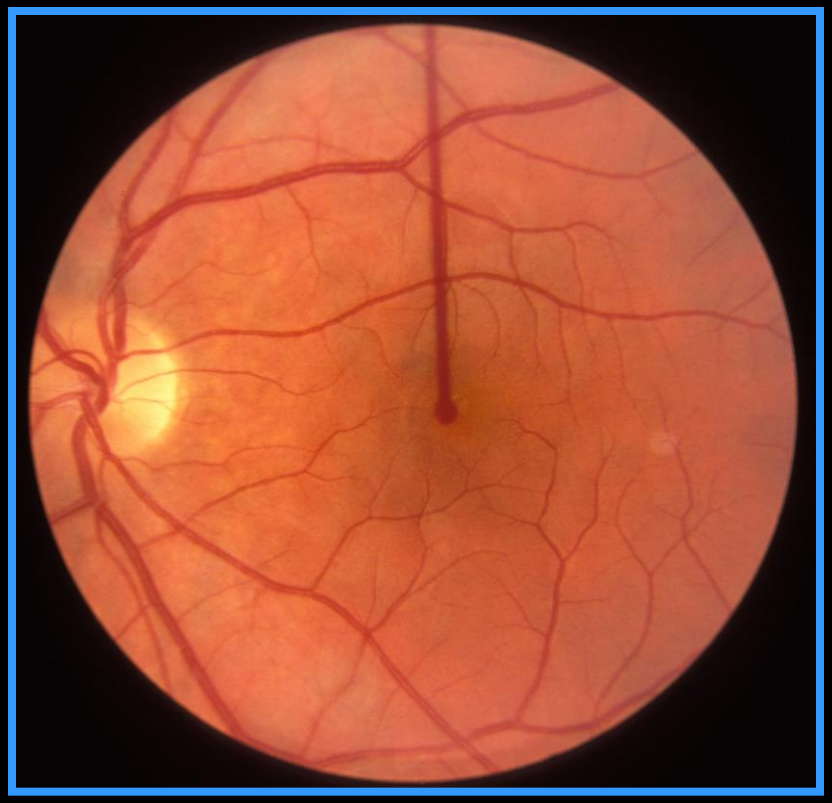
Normal

OD

OS

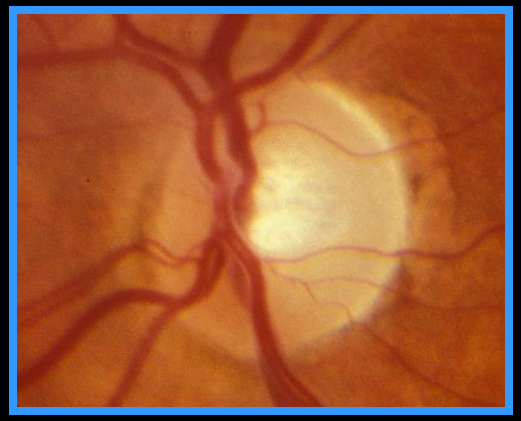
The ocular fundus

Where is the macula?



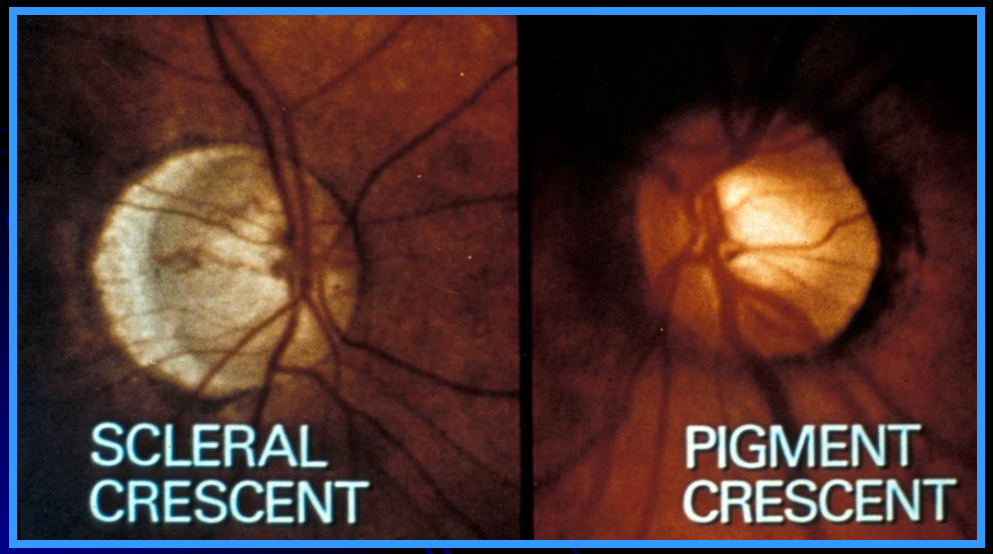
The optic nerve

Normal



The optic nerve

"Normal variants"



Myelinated nerve fibers

The optic nerve

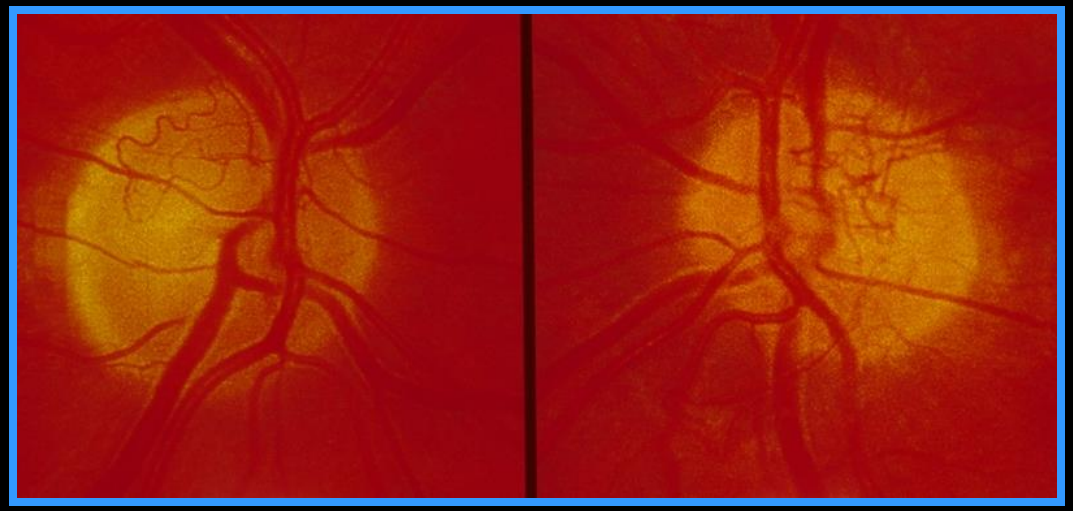
"Choked disc"

or

Papilledema

The optic nerve

Dx?



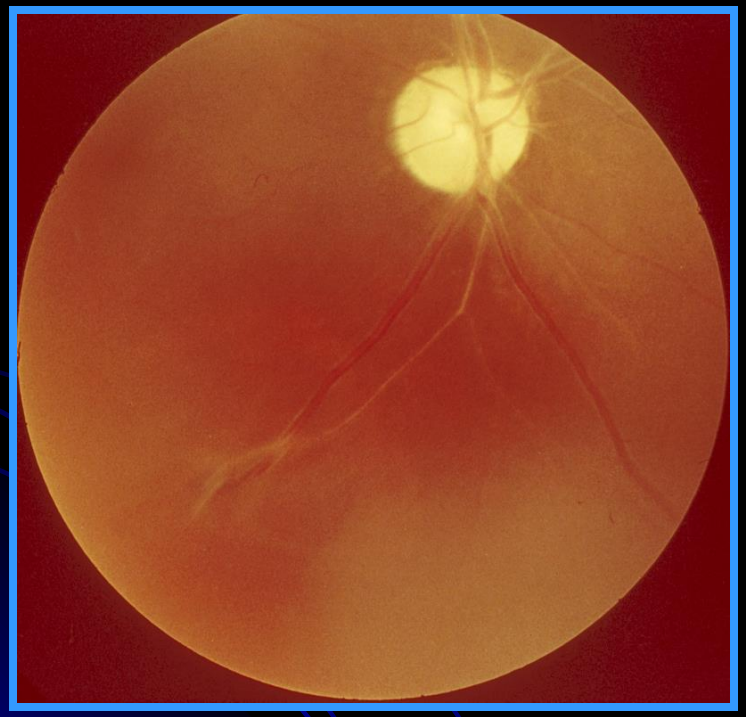
Disc neovascularization

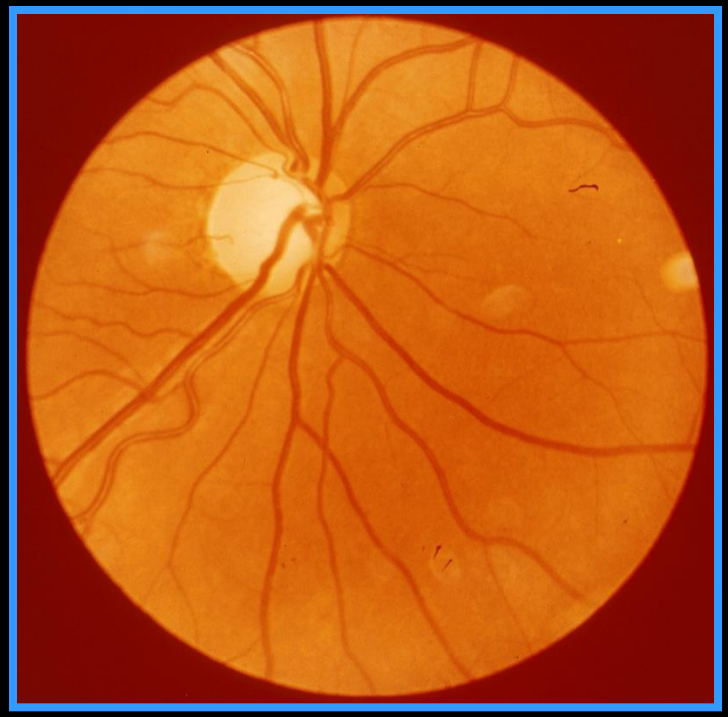
Papilledema with papillary hemorrhages

Dx?

The optic nerve

Optic atrophy



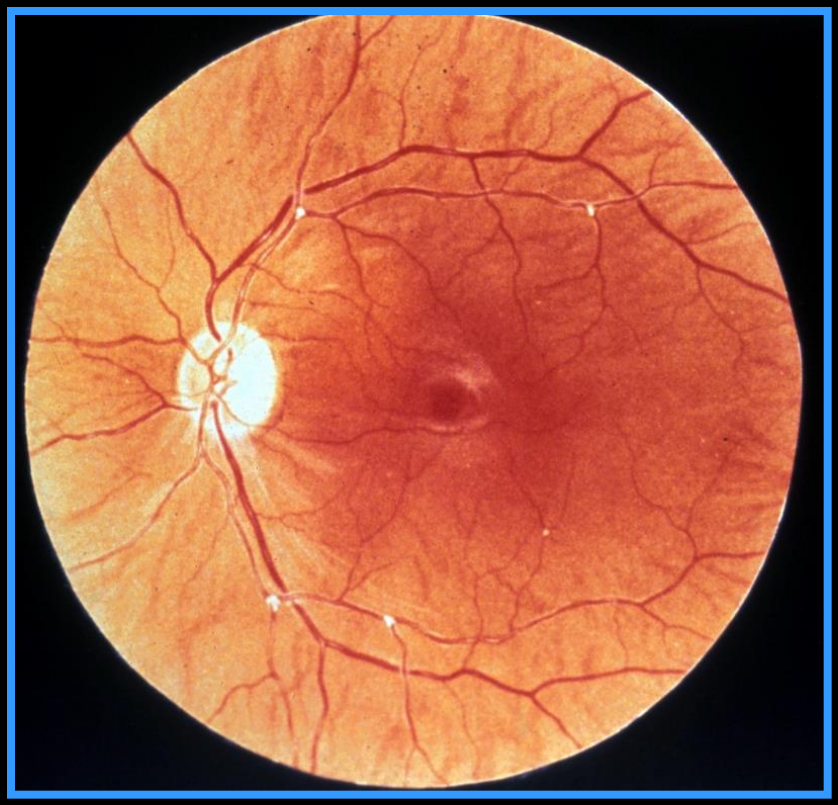


The retina

Arterial occlusions

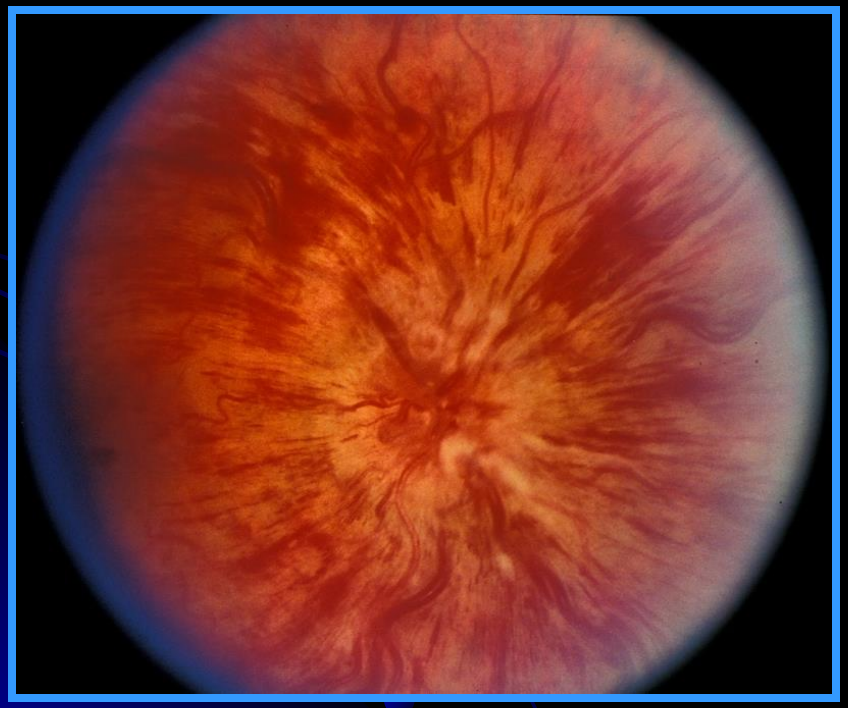
The retina

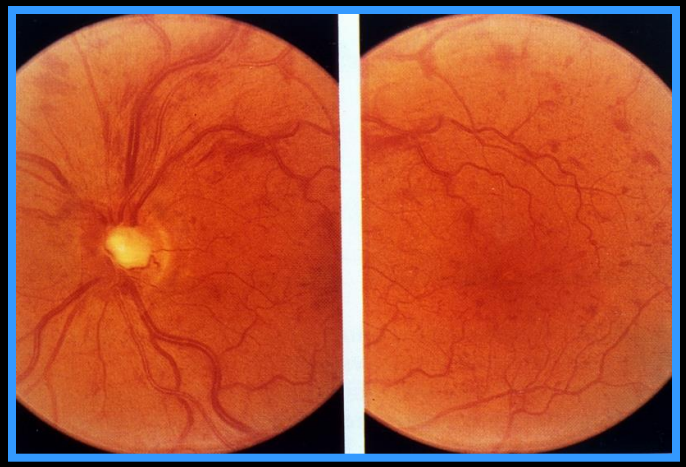
Arterial plaques

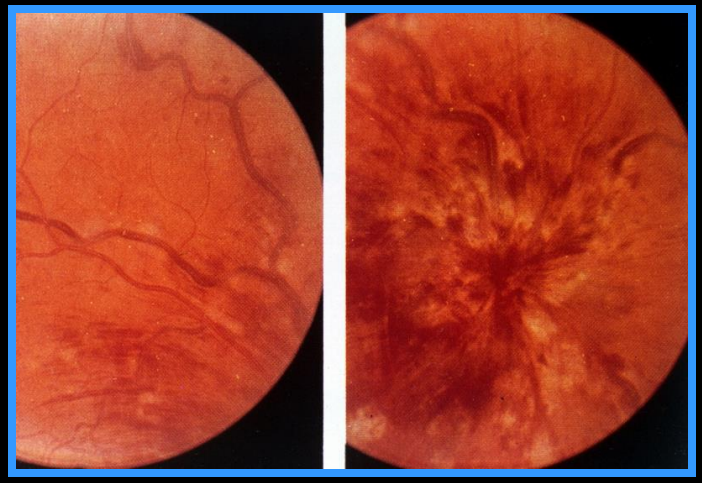


The retina

Venous occlusions





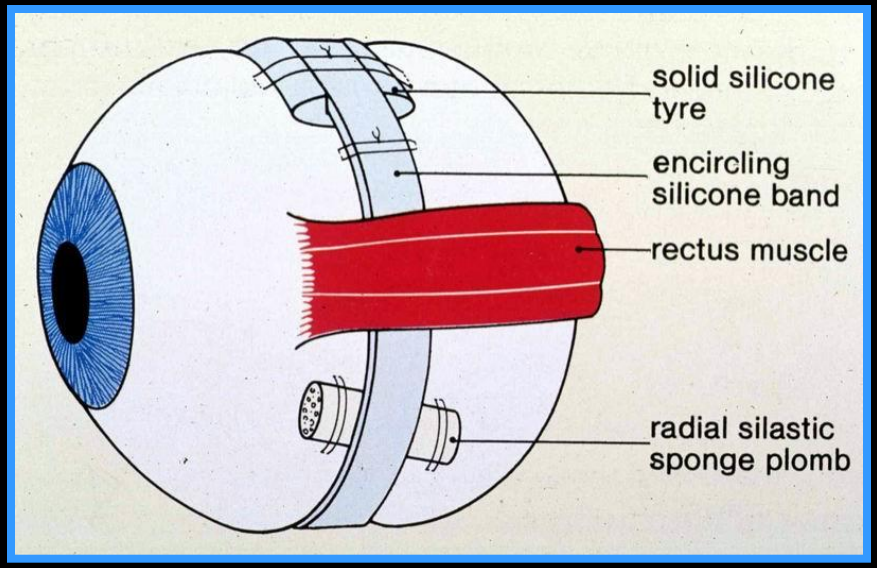


The retina

Detachments

The retina

Retinal detachment repair



Before **After**

Hypertensive retinopathy

Papilledema, papillary hemorrhages, “cotton wool” spots, and narrowed aterioles

Diabetic retinopathy

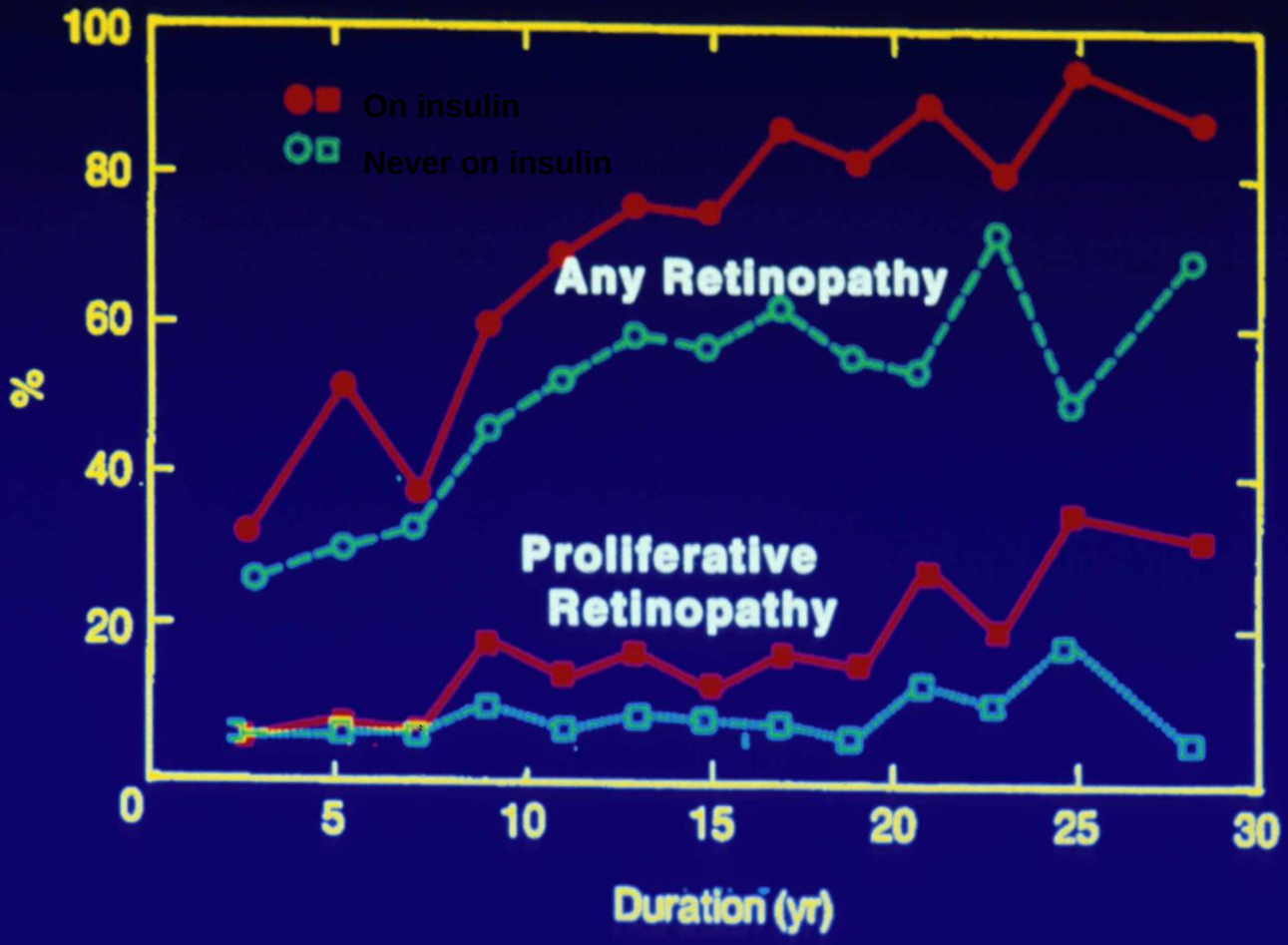
Early background diabetic retinopathy

“Blot and dot hemorrhages”
Hard and soft exudates

Circinate exudates

PREVALENCE OF DIABETIC RETINOPATHY

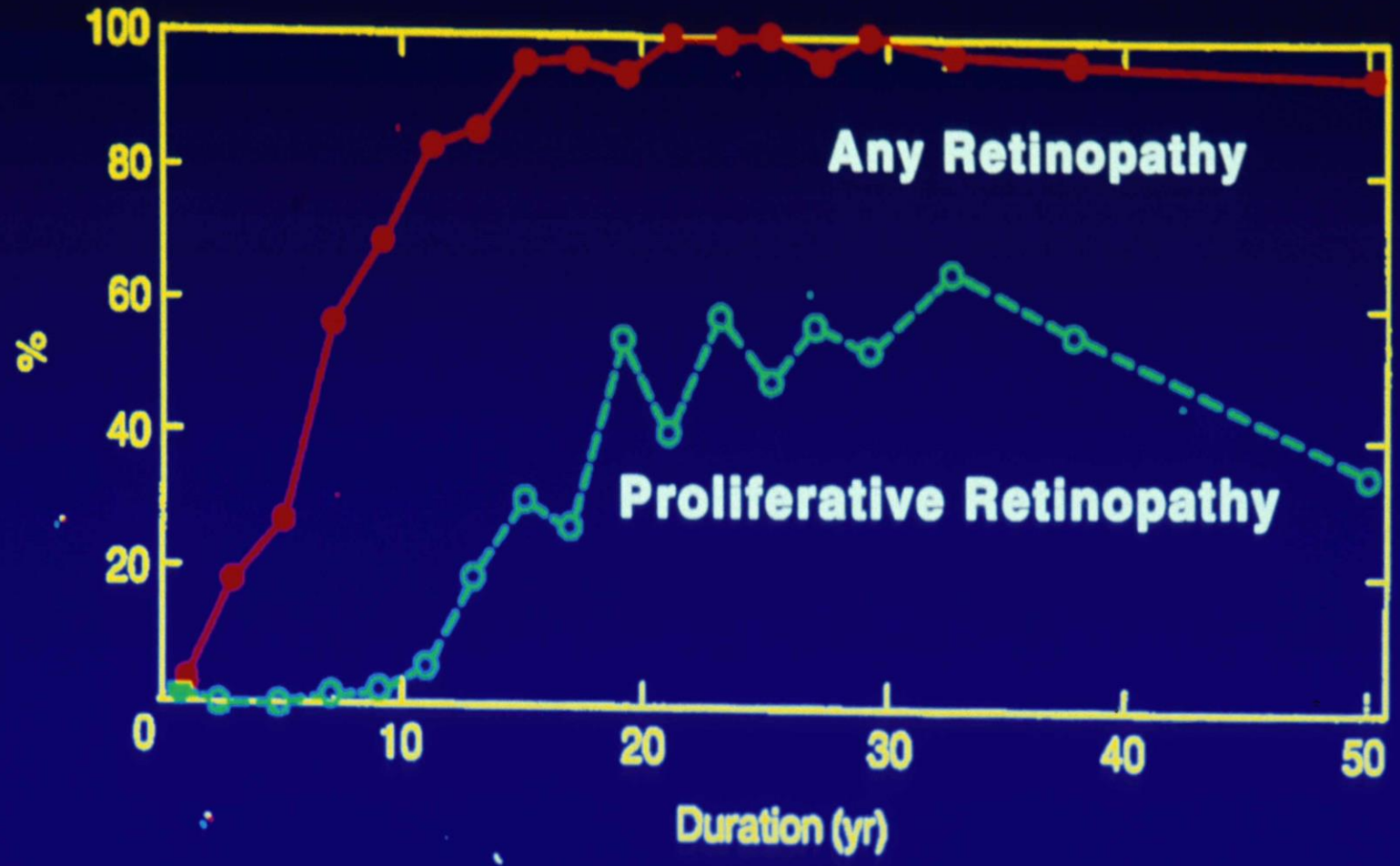
Subjects with Type II Diabetes



From R Klein, et al., Arch. Ophthalmol. 102:527-532, 1984

PREVALENCE OF DIABETIC RETINOPATHY

Subjects with Type I Diabetes



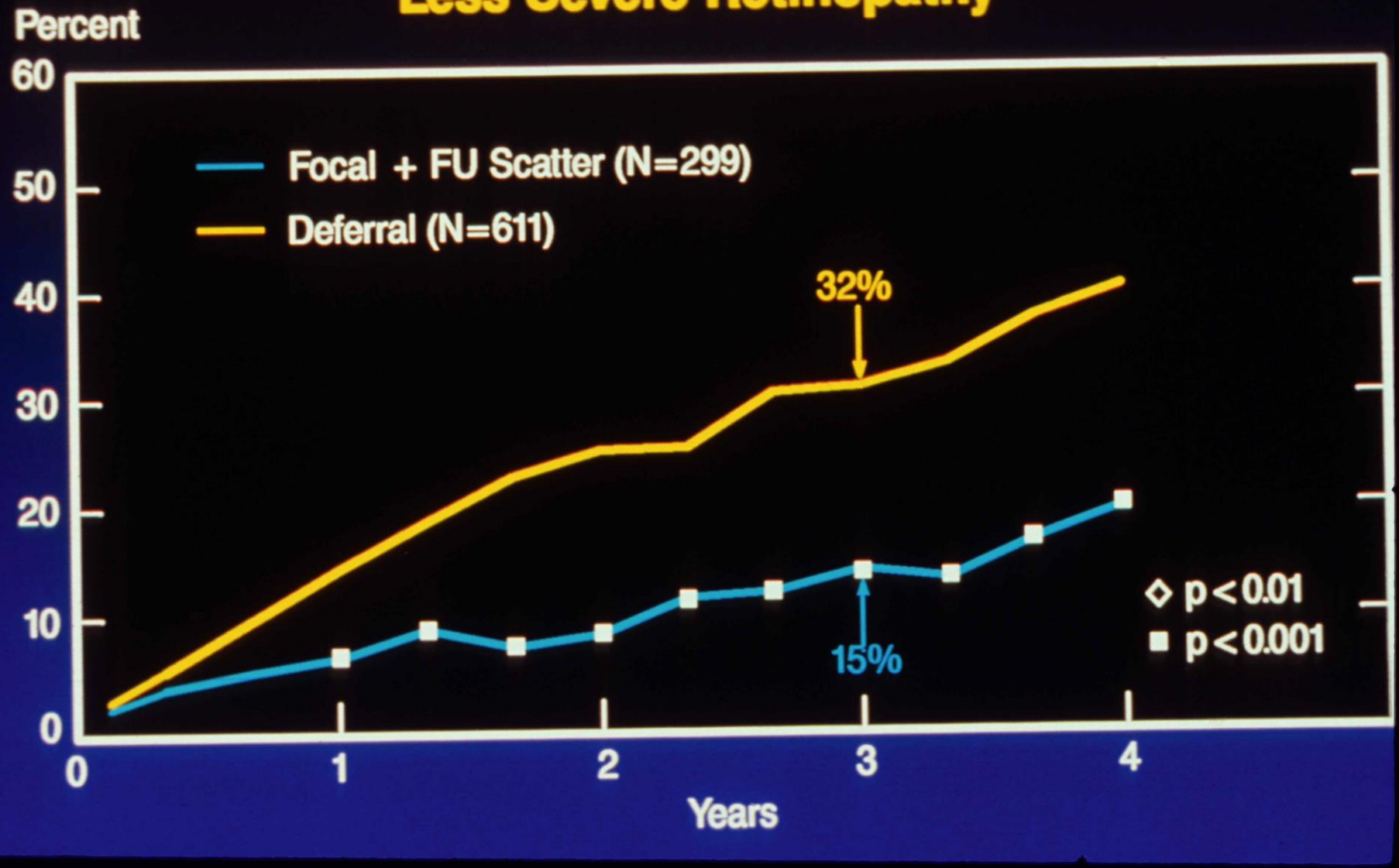
From R Klein, et al., Arch. Ophthalmol. 102:520-526, 1984

DIABETIC RETINOPATHY: Histopathology

- Pericyte loss (physiological role unknown; may stimulate endothelial proliferation, lead to reduced blood flow)
- Basement membrane thickening
- Capillary acellularity (leads to ischemia)
- Endothelial proliferation: microaneurysms
- Neovascularization
- Macular edema

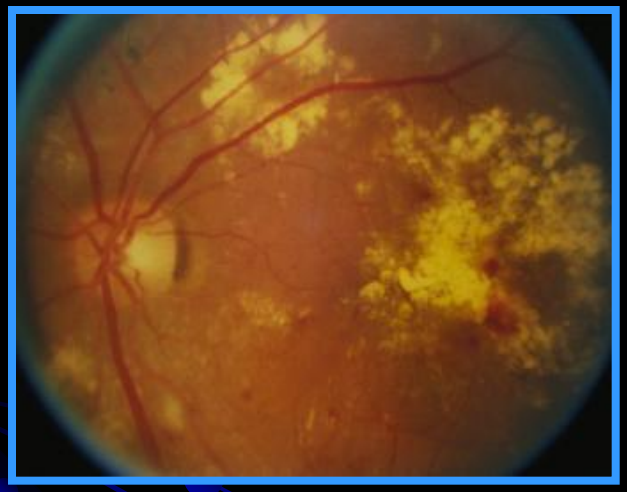
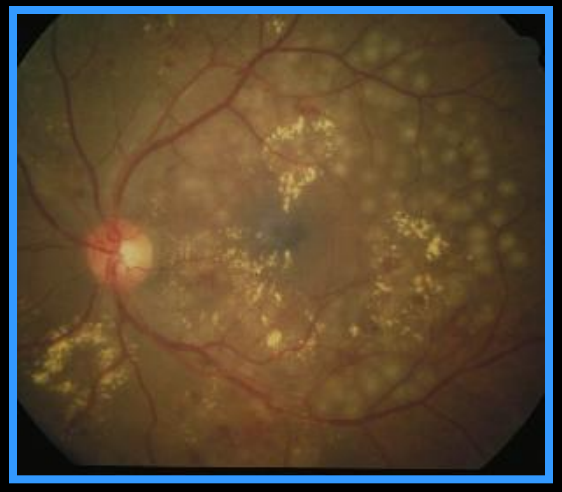
Moderate Visual Loss

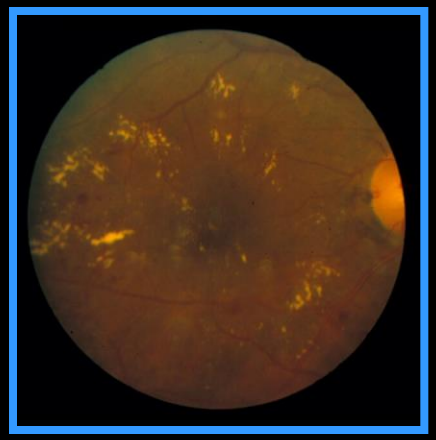
Clinically Significant Macular Edema - Center Involved
Less Severe Retinopathy



Diabetic retinopathy

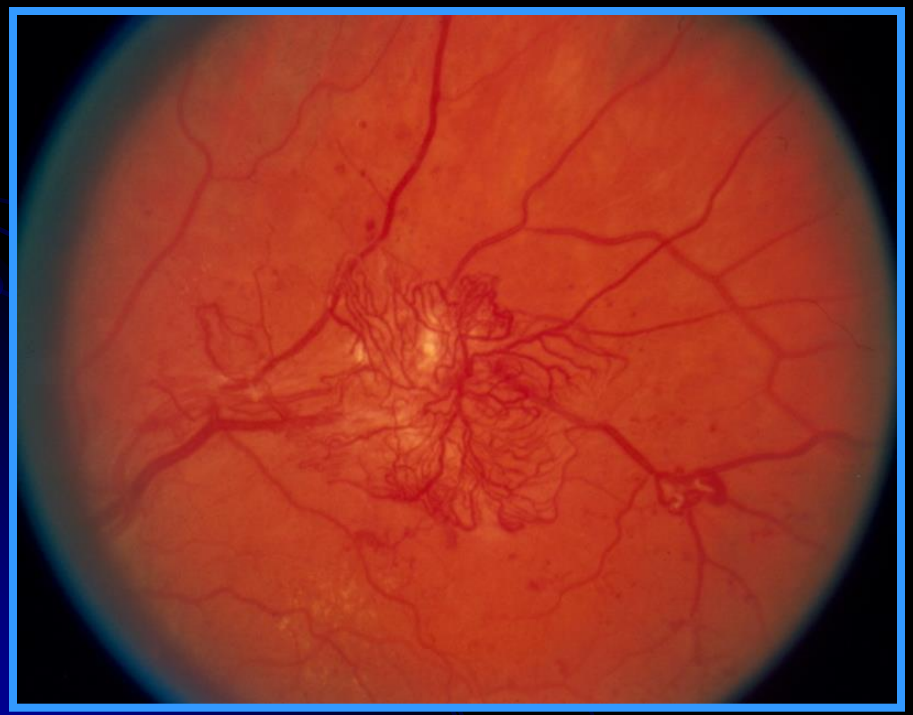
Advanced background diabetic retinopathy

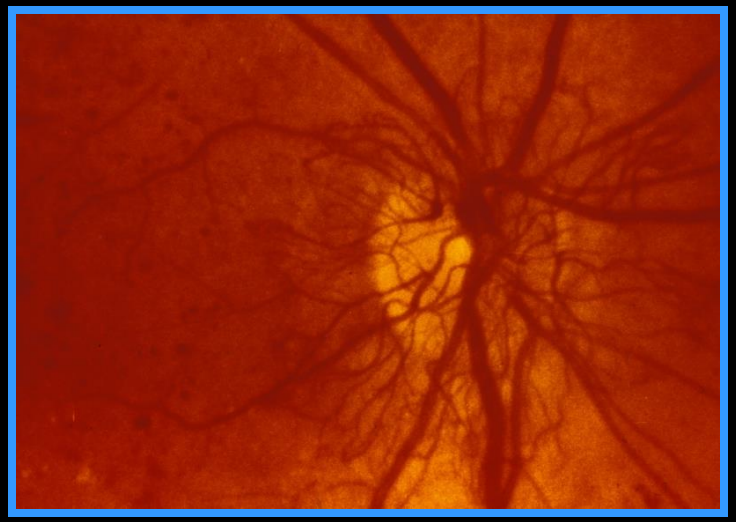



Diabetic retinopathy

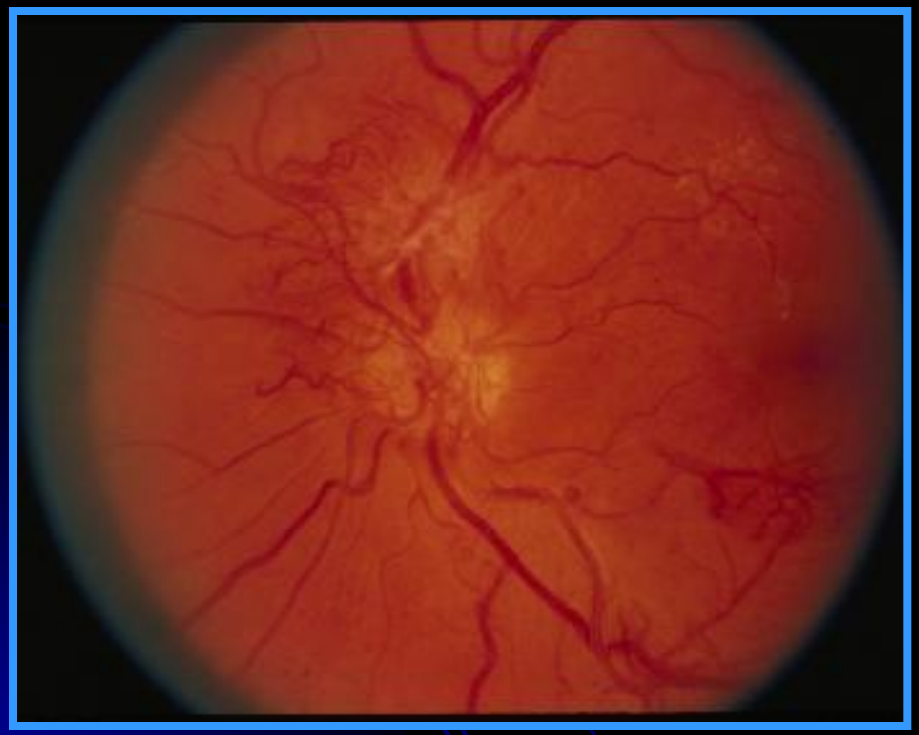
Neovascularization

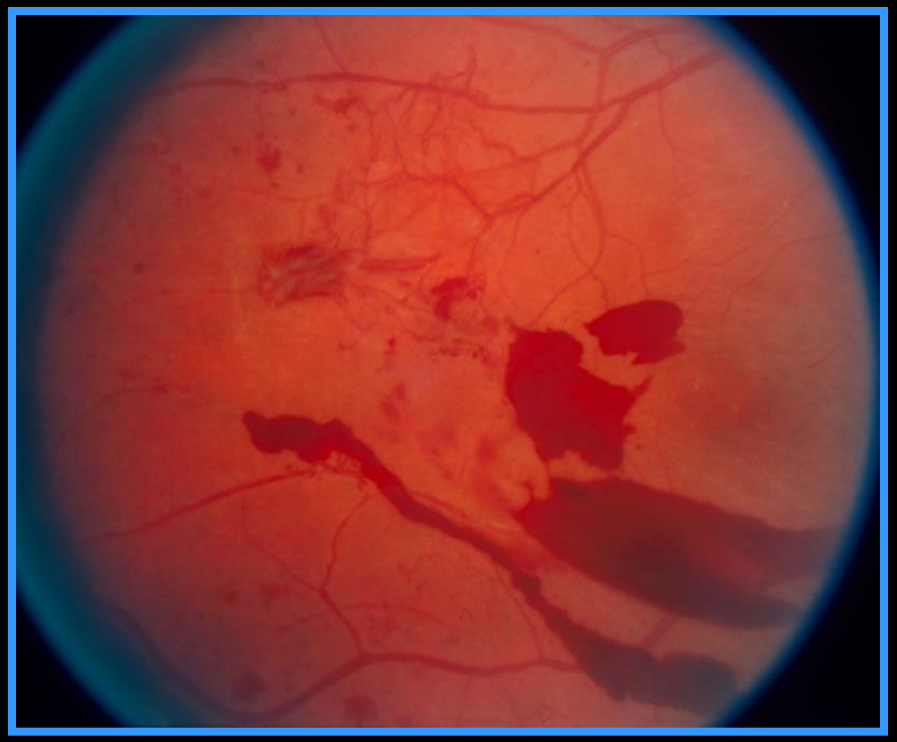




Diabetic retinopathy

Neovascular retinopathy





Diabetic retinopathy

Panretinal photocoagulation

Early reaction

Later changes

Diabetic retinopathy

Advanced stages

Age-related macular degeneration (ARMD)

Hemorrhagic phase

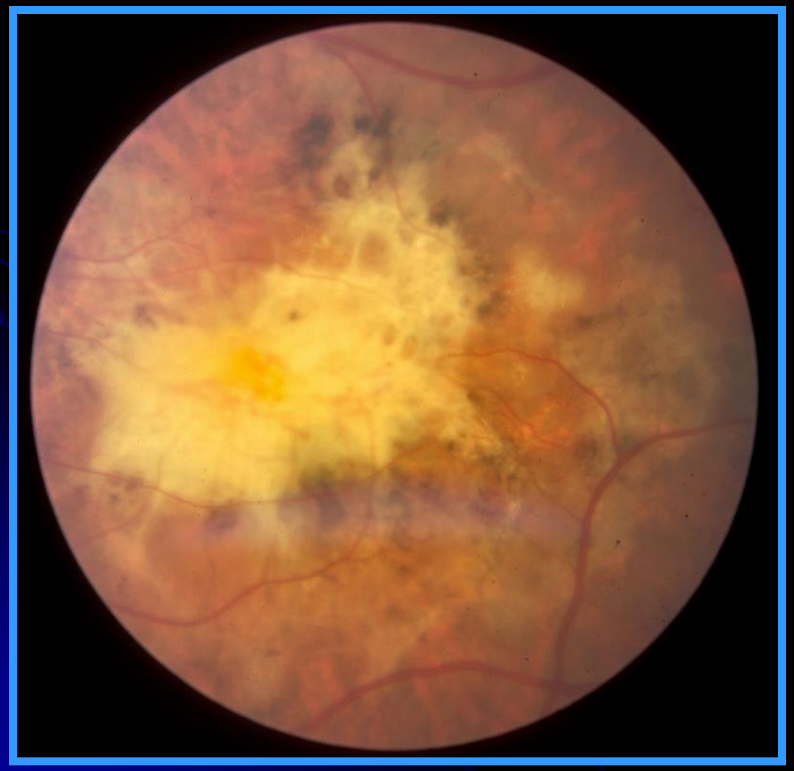
Age-related macular degeneration (ARMD)

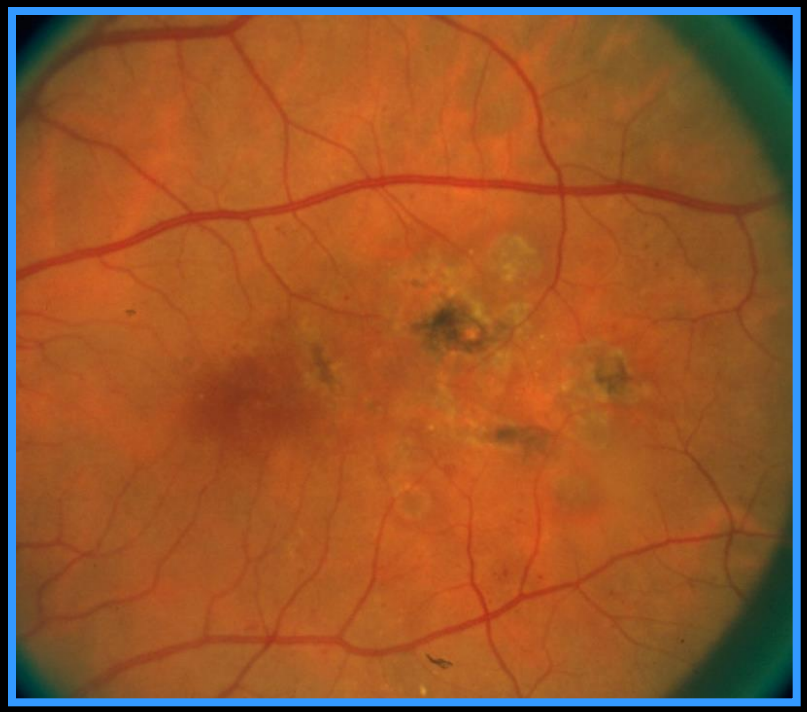
Atrophic ARMD

Drusen

Age-related macular degeneration (ARMD)

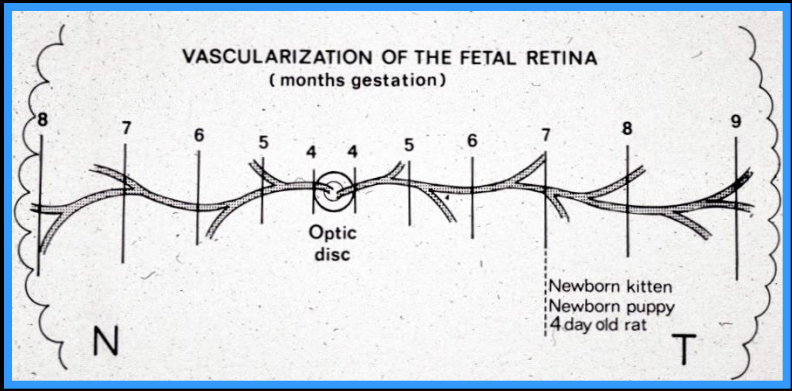
End-stage gliosis



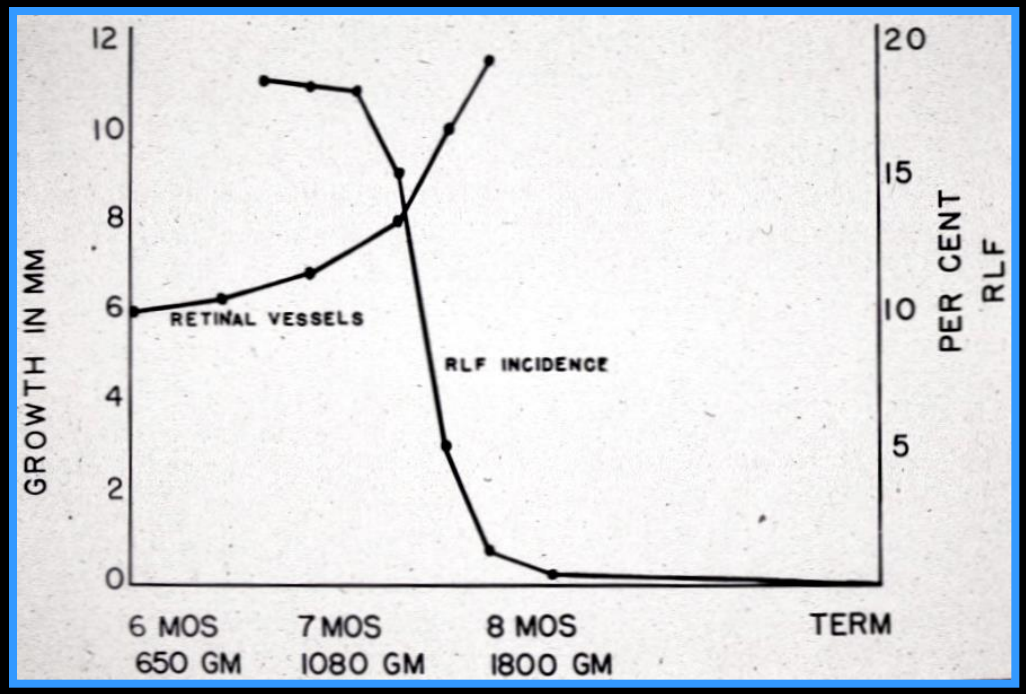


Laser treatment

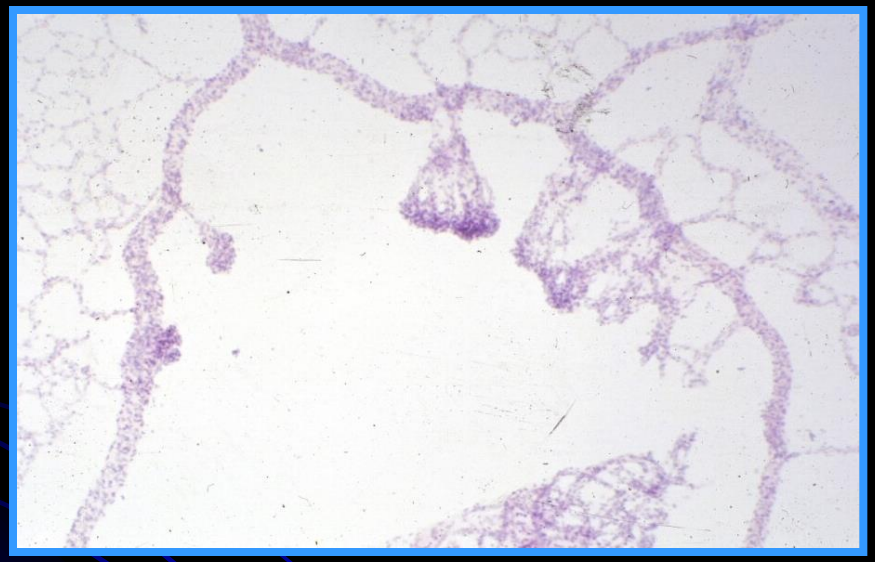
Retinopathy of prematurity (ROP)

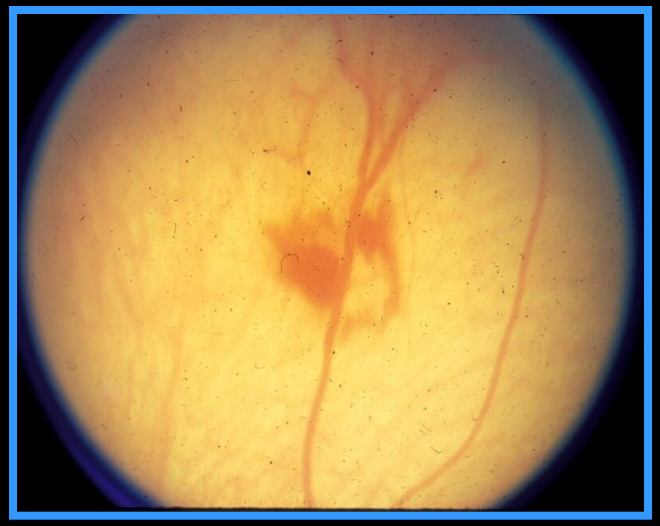


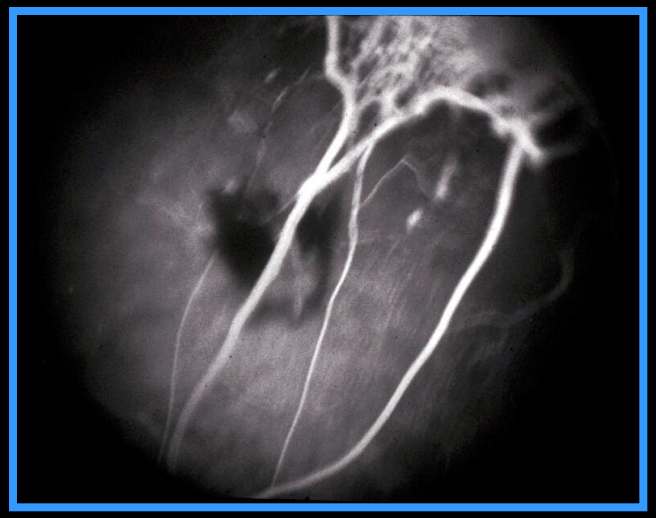
Maturity of retinal vasculature and risk of retinopathy of Prematurity (ROP)



Retinopathy of prematurity (ROP)



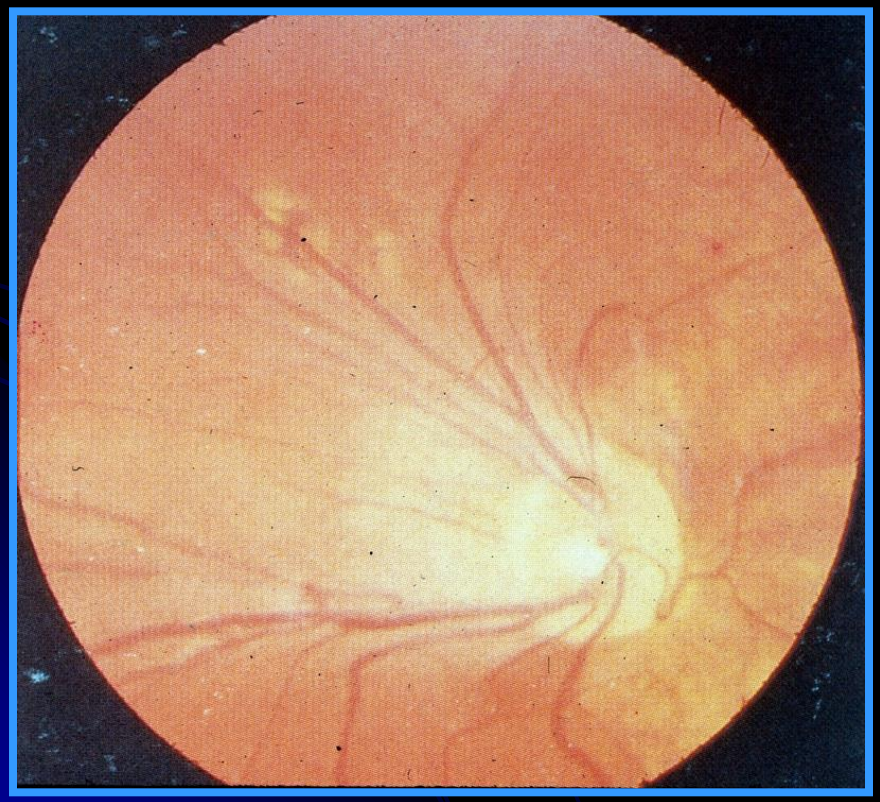


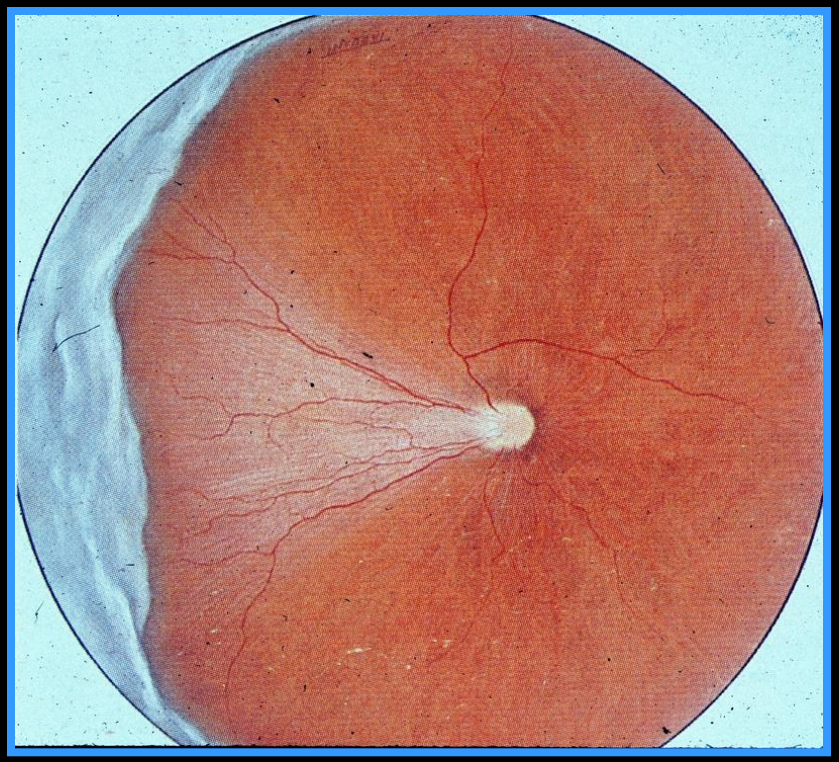


Peripheral new vessel growth

Retinopathy of prematurity (ROP)

Temporal scarring with dragged macula






THANK YOU ALL FOR LISTENING!