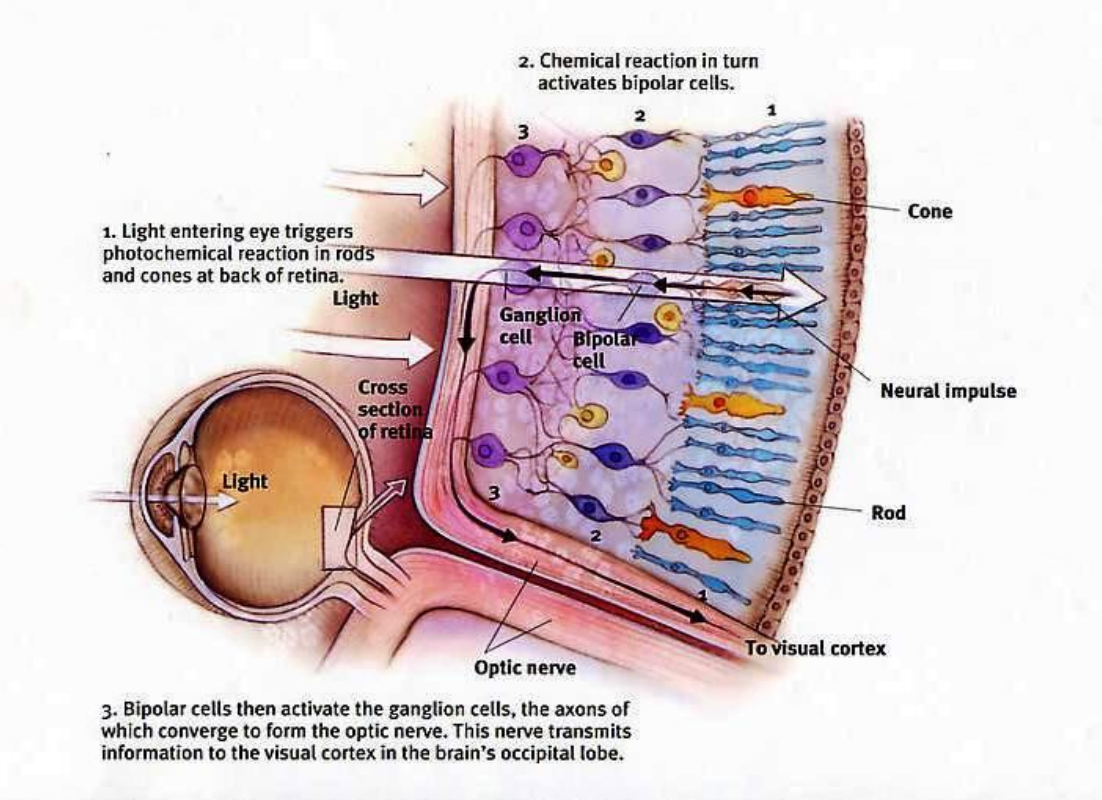
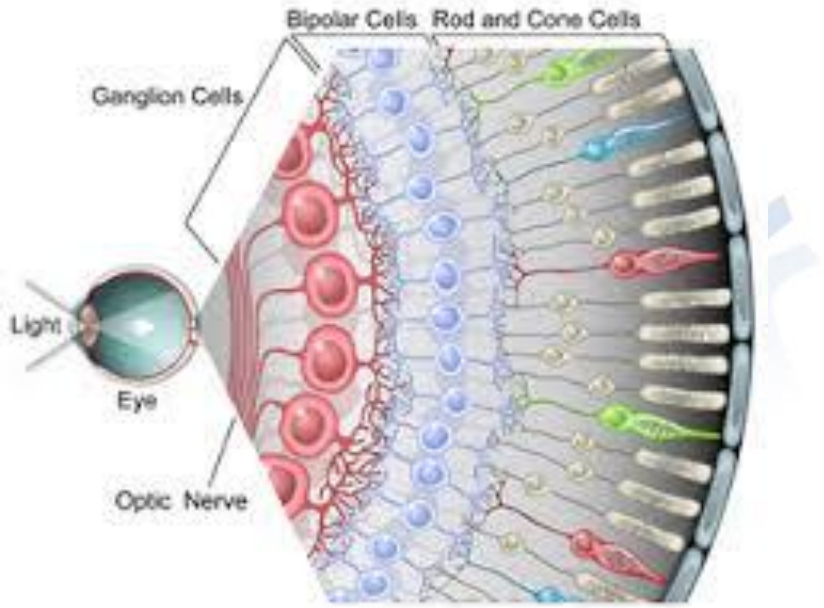
Retina

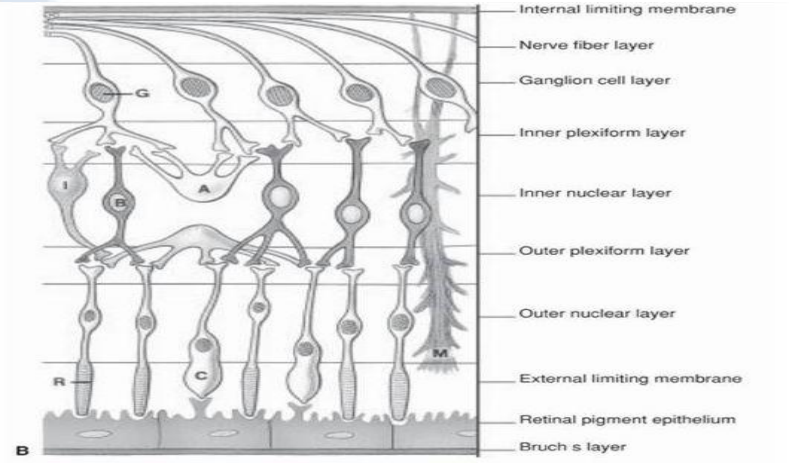
The retina is the photosensitive layer of the eye where light energy is converted to electrical impulses, which transmitted to the brain through the optic nerve.

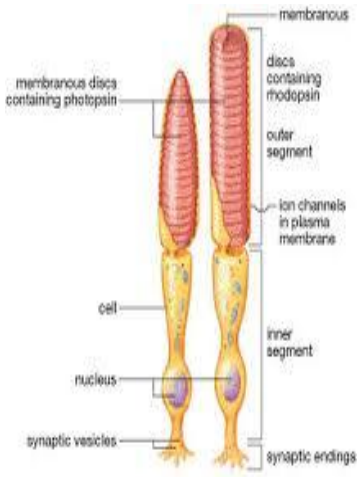


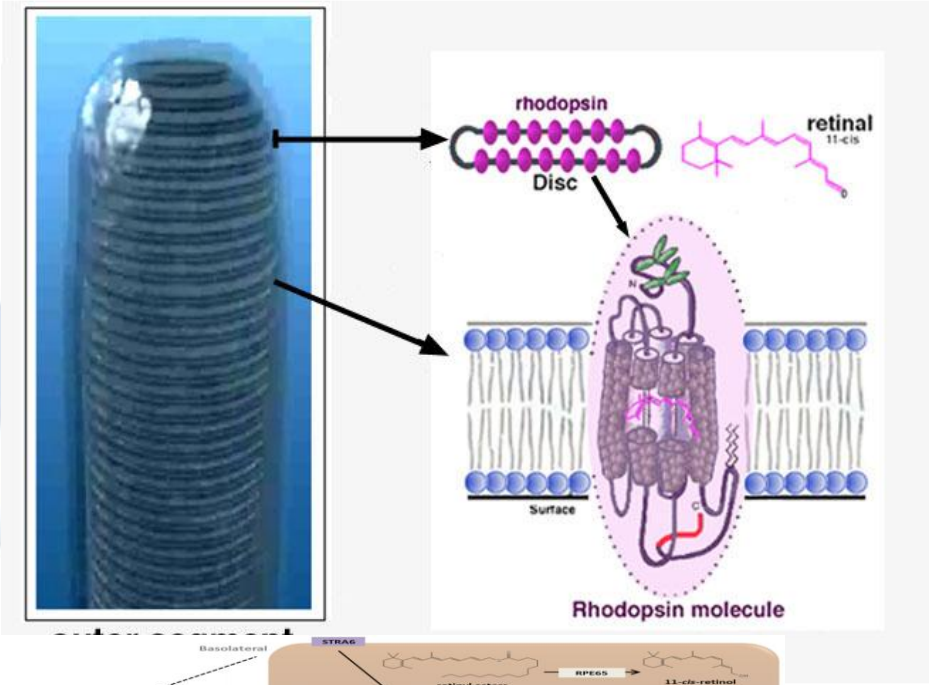
Retina consists of two main layers:

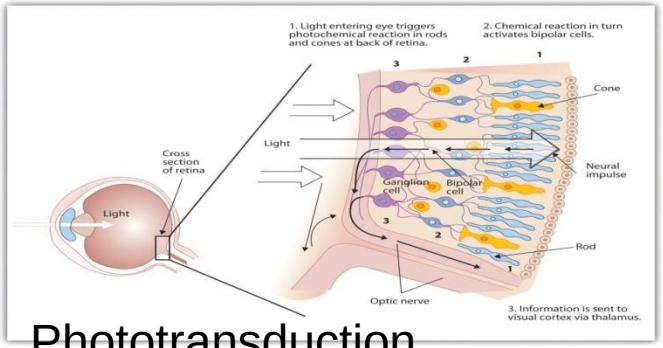
- A-The outer layer the Retinal pigment layer (RPE)
- B-The inner layer the Sensory layer,
- 1-Photoreceptors (Cones and Rods)
- 2-Outer limiting membrane
- 3-Outer nuclear layer
- 4-Outer plexiform layer
- 5-Inner nuclear layer
- 6-Inner plexiform layer
- 7-Ganglion layer
- 8-Nerve fiber layer
- 9-Inner limiting membrane

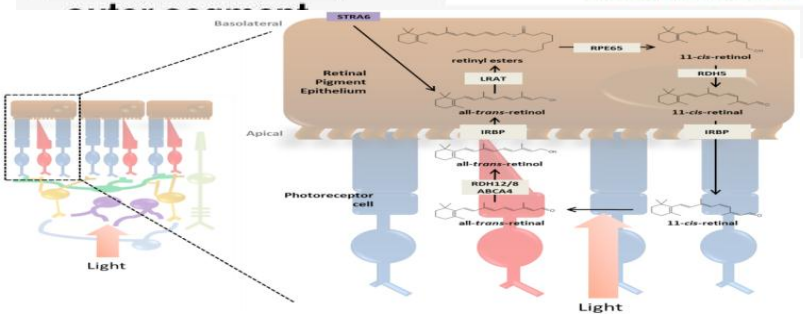












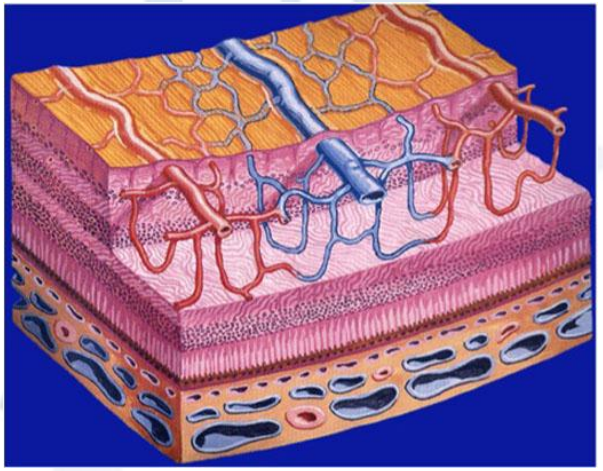
Phototransduction

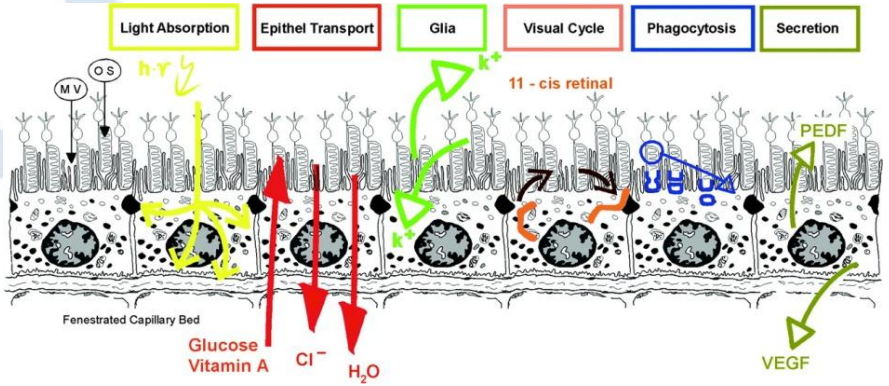
Visual cycle. Absorption of light by visual pigments (rhodopsin or cone opsin) causes isomerization of 11-cis-retinal to all-trans-retinal,

Oxygen and nutrients supply:

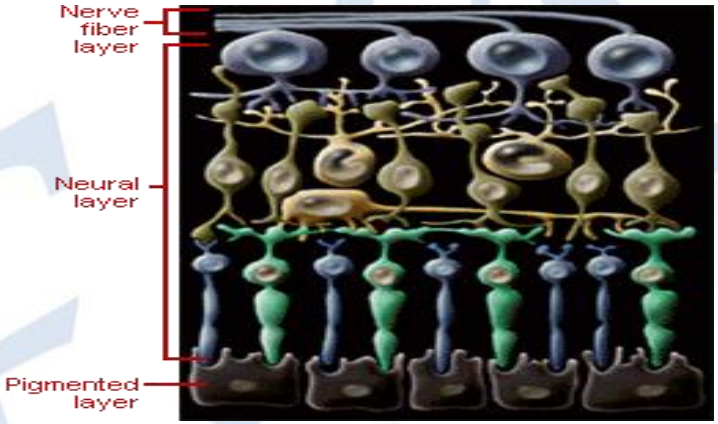
Inner layers supplied by central retinal artery

Photoreceptors supplied by choriocapillaries



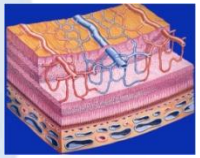


- **Retina consists of densely packed cells**
  Extra-cellar space is only 1%

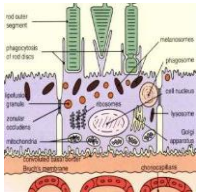


- **Retinal-Blood Barrier**:

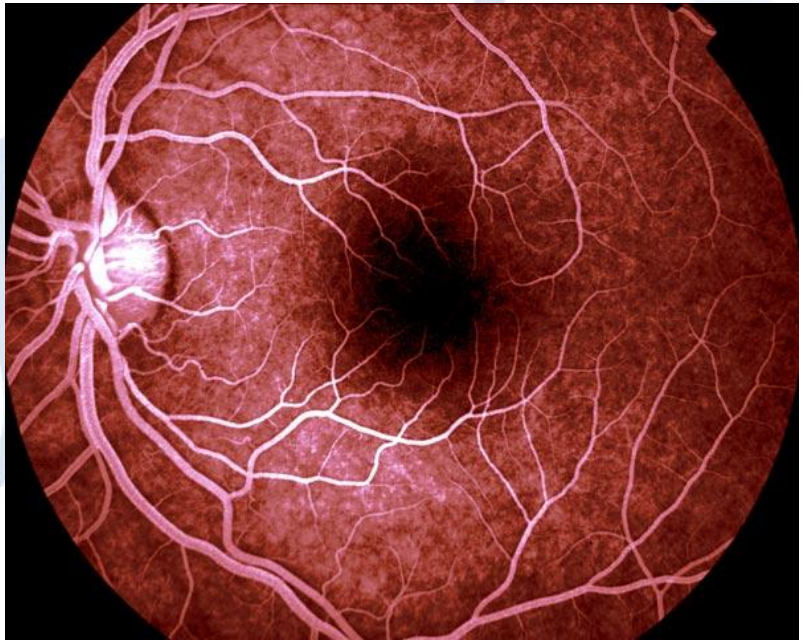
-**Inner**: tight junctions between the endothelial cells of retinal capillaries



- **Outer**: tight junctions between the retinal pigment epithelial cells

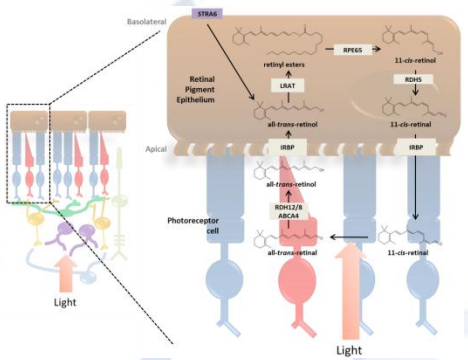


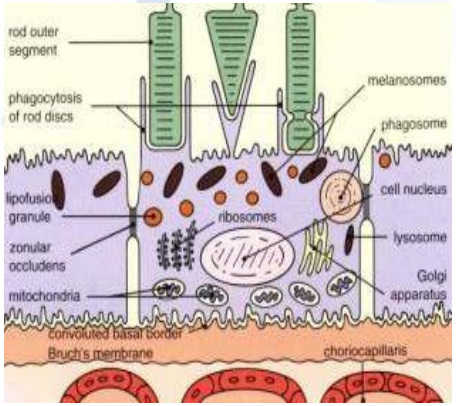
Retinal vessels are
End arterioles

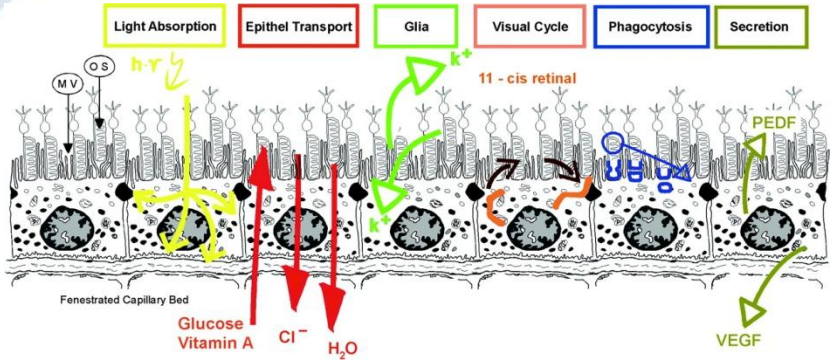


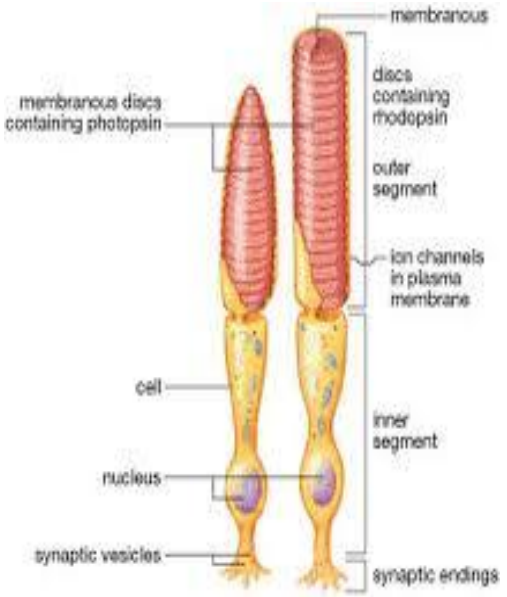
Functions of Retinal pigment epithelium:

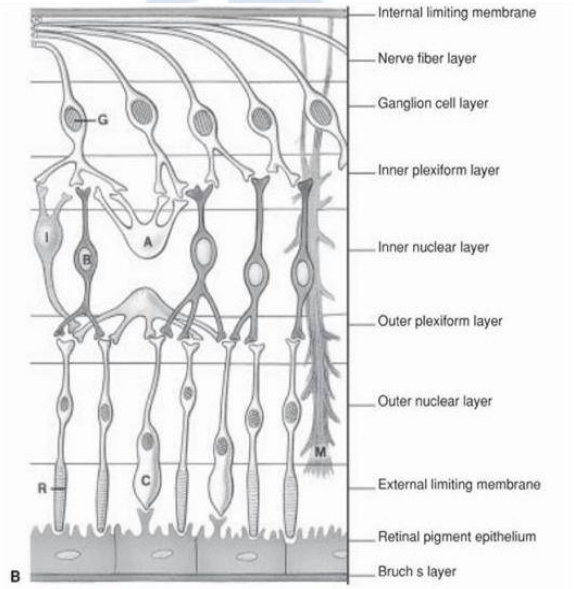
1- Regenerates the visual pigments after phototransduction
2- Passage of O2 and nutrients from choroid to the photoreceptors
3- Outer retinal blood barrier
4- Absorb scattered light

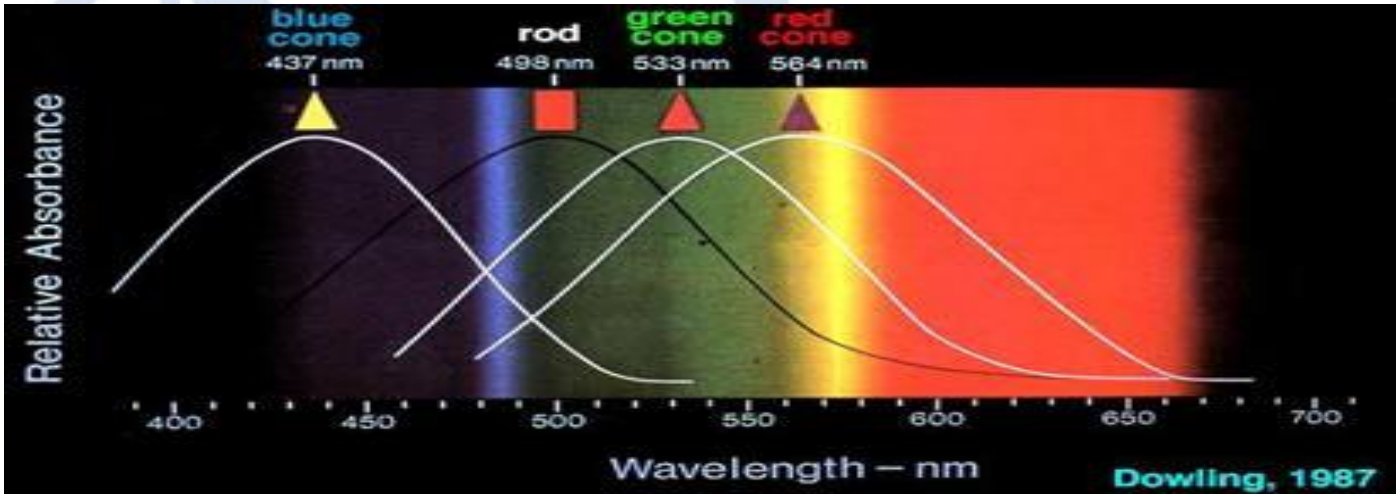




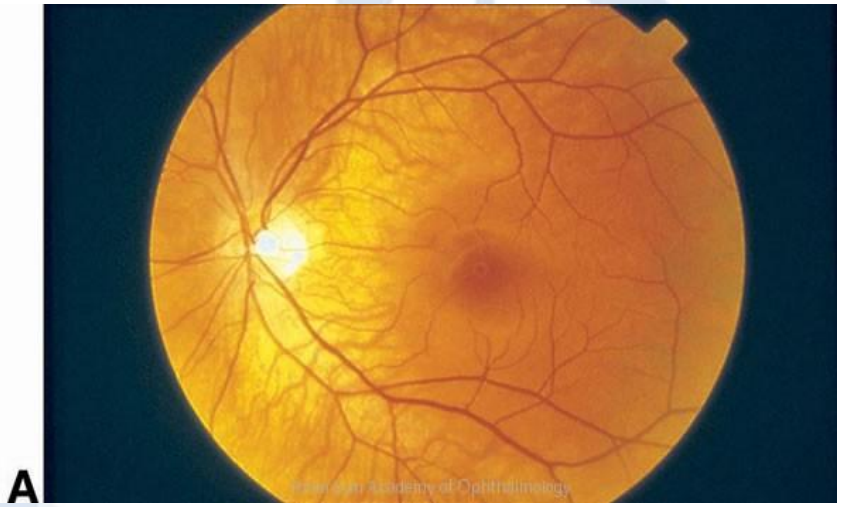


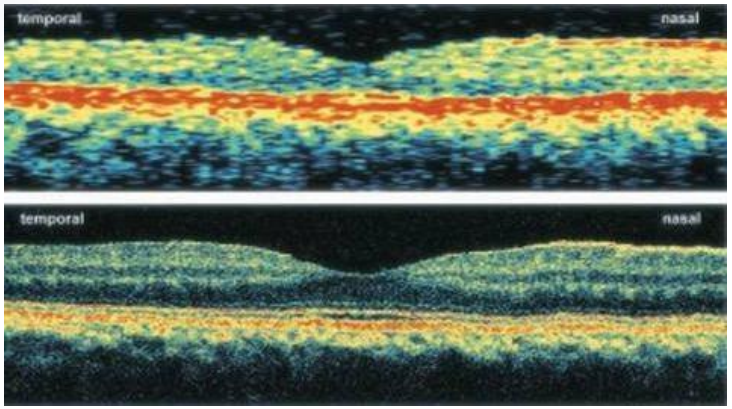

membranous
membranous discs containing photopsin
discs containing rhodopsin
outer segment
ion channels in plasma membrane
cell
inner segment
nucleus
synaptic vesicles
synaptic endings


Internal limiting membrane
Nerve fiber layer
Ganglion cell layer
Inner plexiform layer
Inner nuclear layer
Outer plexiform layer
Outer nuclear layer
External limiting membrane
Retinal pigment epithelium
Bruch s layer
G
I
B
A
M
R
C
B


blue cone
437 nm
rod
498 nm
green cone
533 nm
red cone
564 nm
Relative Absorbance
400
450
500
550
600
650
700
Wavelength – nm
Dowling, 1987

- **Macula**; an oval area in the posterior pole about 5 mm in diameter, correspond to central 15^{o} of visual field.
- **Fovea;** central part in the macula about 1.5 mm in diameter correspond to the central 5^{o} in the visual field.
- **Foveola:** central depression in the fovea about 0.35 mm in diameter contains cones only, and correspond to the central 1^{o} of the most precise vision in the visual field.





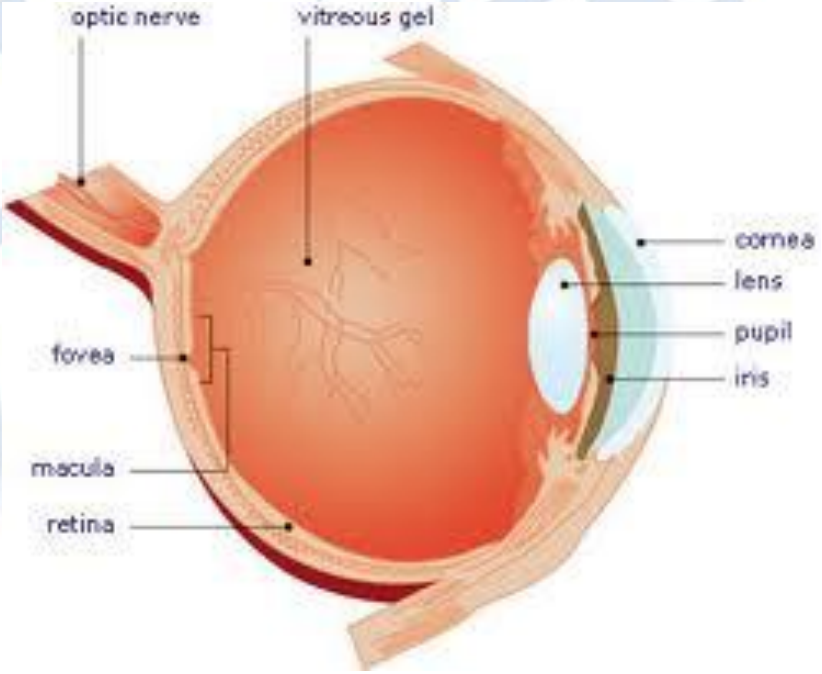
The vitreous:

a clear gel occupying two-thirds of the globe, consists:

- **water 98%.**
- **hyaluronic acid**
- **fine collagen network**
- **There are few leukocytes.**

Vitreous firmly Attached to the peripheral retina, and around the optic disc

.



Symptoms of retinal disorders:

1- Painless impairment of vision.

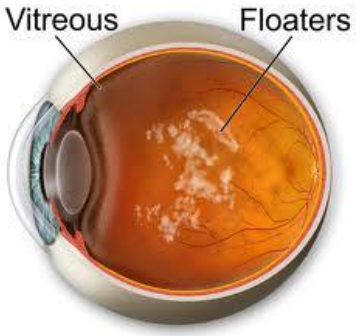
2 - Distorted vision (*metamorphopsia) caused by a disturbance in the* arrangement of the photoreceptors in macular diseases such as reduction (*micropsia) or enlargement (macropsia) of object size*

3-Impairment of color vision which occurs in macular diseases

4- Visual field defects

5-Floaters (perception of moving images in the field of vision, caused by vitreous opacities that cast a shadow on the retina).

6-Photopsia (perception of flashes of light)

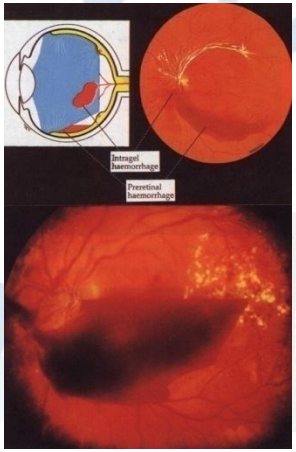


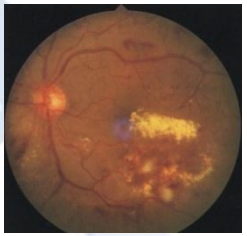
Signs

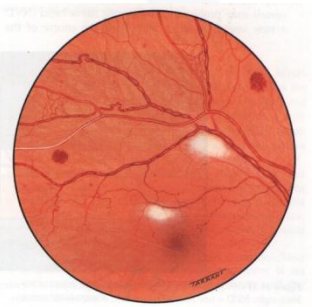
1-Depressed Visual acuity

2-Impairment of Pupillary light reflex

3-Vitreous opacities
Hemorrhage
WBC
Pigment dots (Tobacco dust)

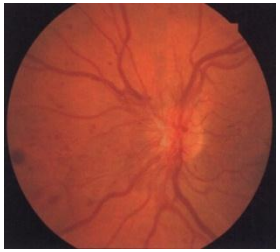




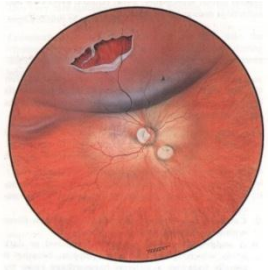


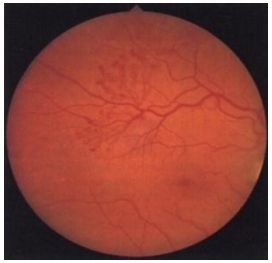
4-Retinal hemorrhage
- Hard exudates: yellow spots well demarcated margins , deposition of lipoproteins, or lipid, are sign s of abnormal vascular leakage
- Cotton wool spots: fluffy white spots with indistinct margins, accumulation of axoplasmic debris in the nerve fiber layer , they are sins of retinal ischemia (micro-infraction of the nerve fiber layer)

5-Abnormal position (Retinal detachment)



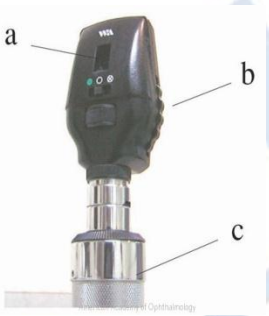
6-Neo-vascularization: retinal ischemia ; secretion of vaso-formative factors
NVD (neo-vascularization on the surface of the optic disc)
NVE (neo-vascularization on the surface of the retina).

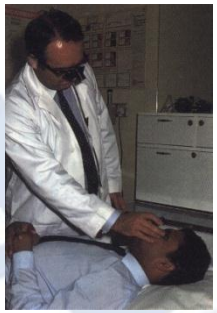




Examination of the retina

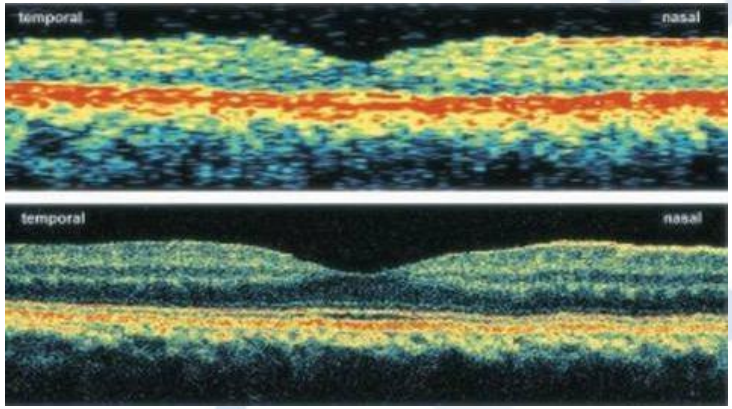
- Direct ophthalmoscope
- Indirect ophthalmoscope

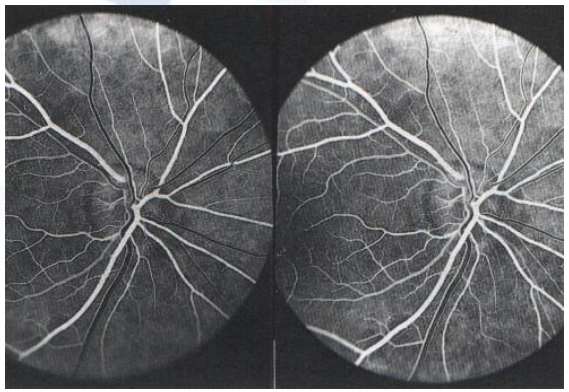




Investigations

- Fluorescein angiography-FA
- Optical coherence tomography-OCT





Diabetic Retinopathy

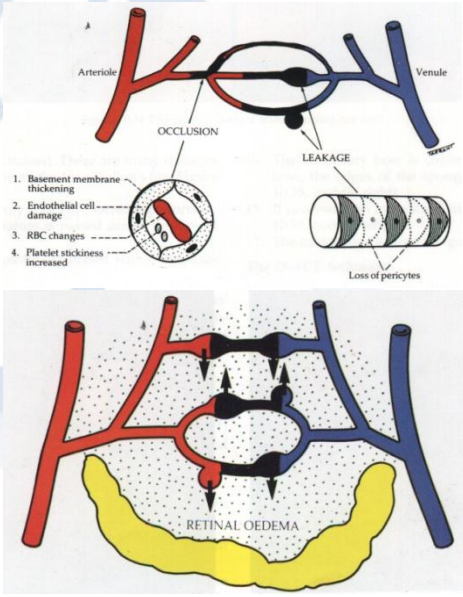
One of the most important causes of blindness

- Risk factors:

1-Duration of diabetes. After 10 years 50% have retinopathy, while after 30 years 90% have retinopathy
2-Poor metabolic control
3-Hypertension
4-Nephropathy
5-Pregnancy
6-Others; smoking, obesity, hyperlipidaema.

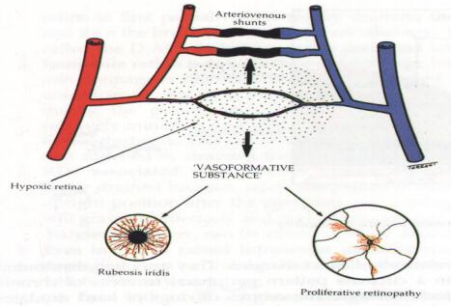
Pathogenesis:

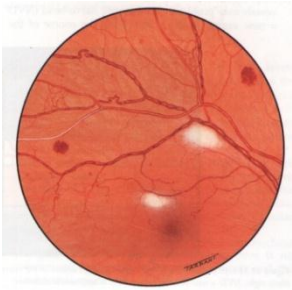
It is a microangiopathy, affecting pre-capillary arterioles, capillaries, and post-capillary venules.



- 1- Micro-vascular leakage
  -microaneurysms
  -Hard exudates

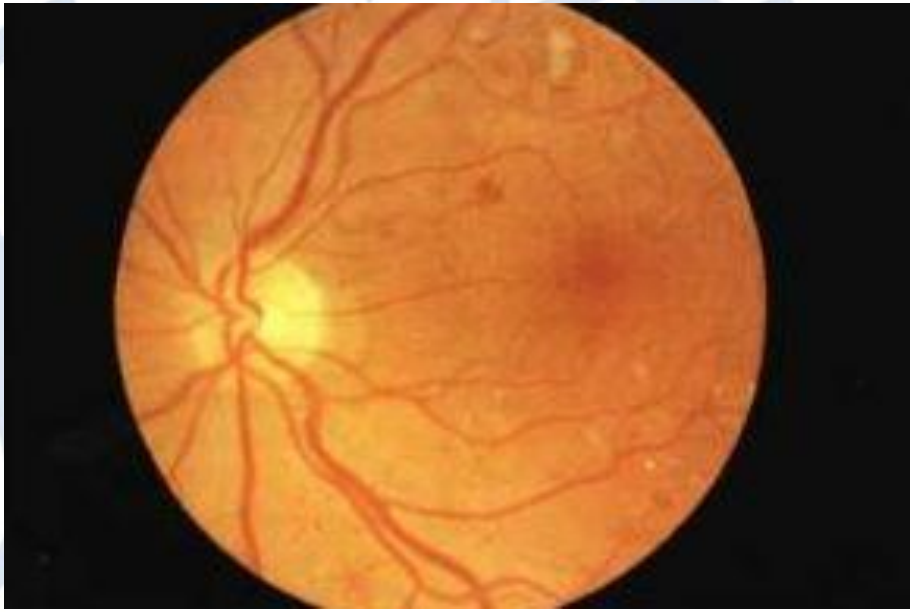
- 2- Micro-vascular occlusion
  Cotton wool spots
  Formation of abnormal neo-vascularization on the surface of the retina (NVE) and on the optic disc (NVD).



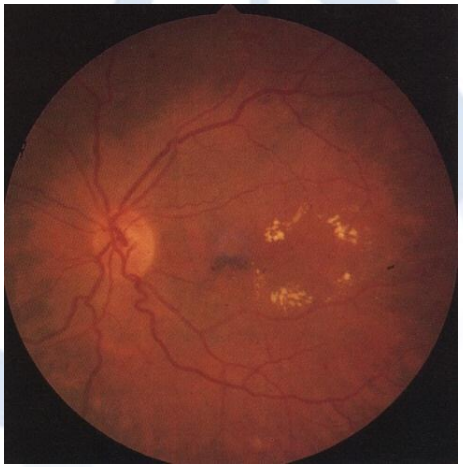


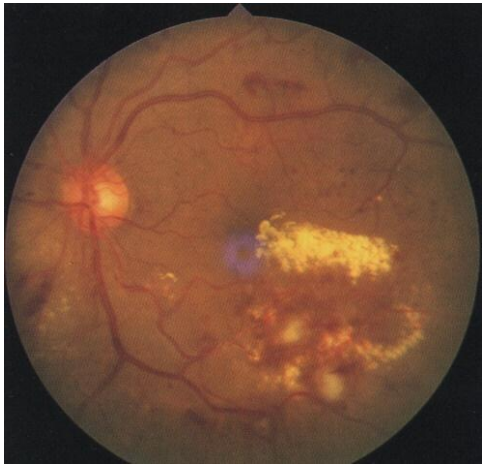
Classification of diabetic retinopathy;

1-Background (non-proliferative) microaneurysms, Retinal hemorrhages (blot and dots), and hard exudates.



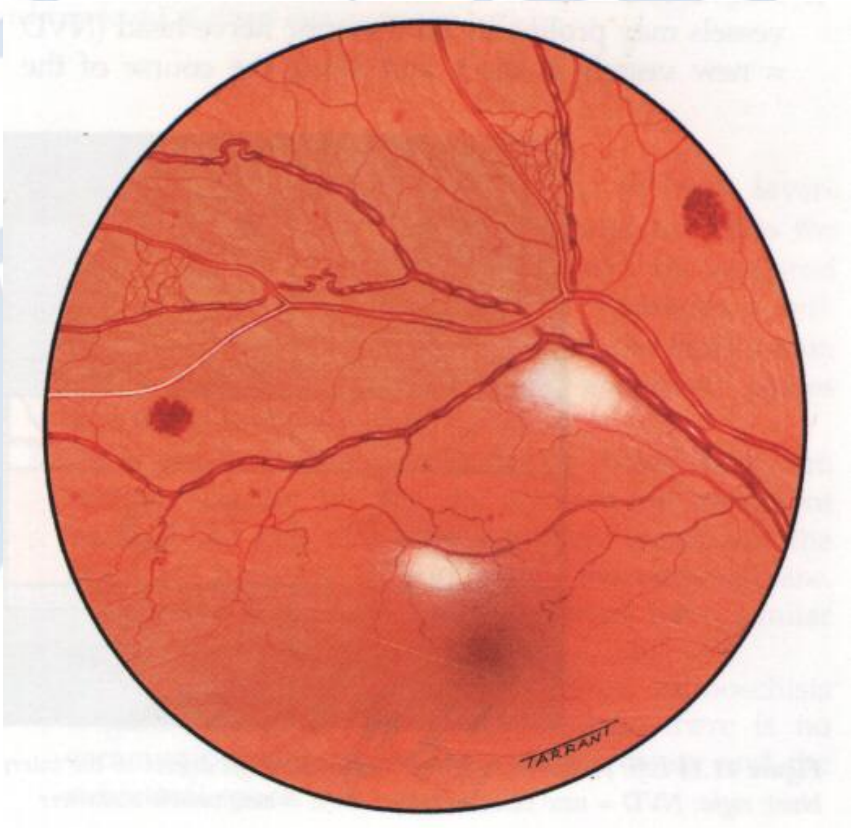
- 2-Maculopathy, (clinical significant macular edema). Microaneurysms, hemorrhages, and hard exudates at the macula.
- Vision is impaired





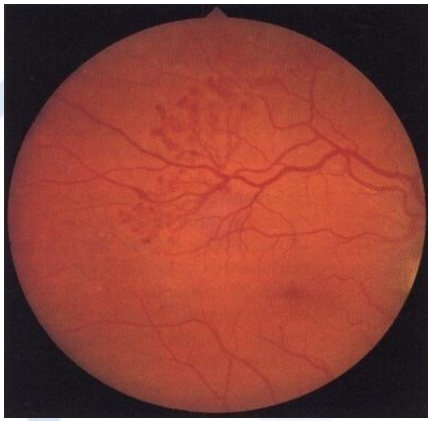
3-Pre-proliferative. Large retinal hemorrhage, cotton wool spots

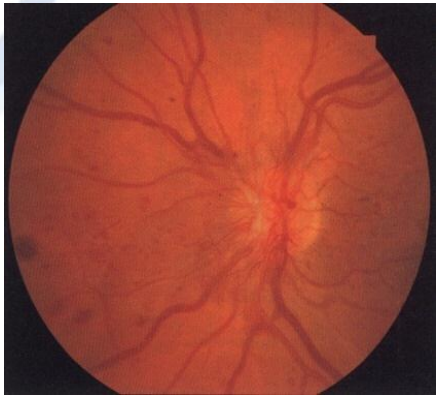
(infarction in the nerve fiber layer), venous congestion and dilatation.

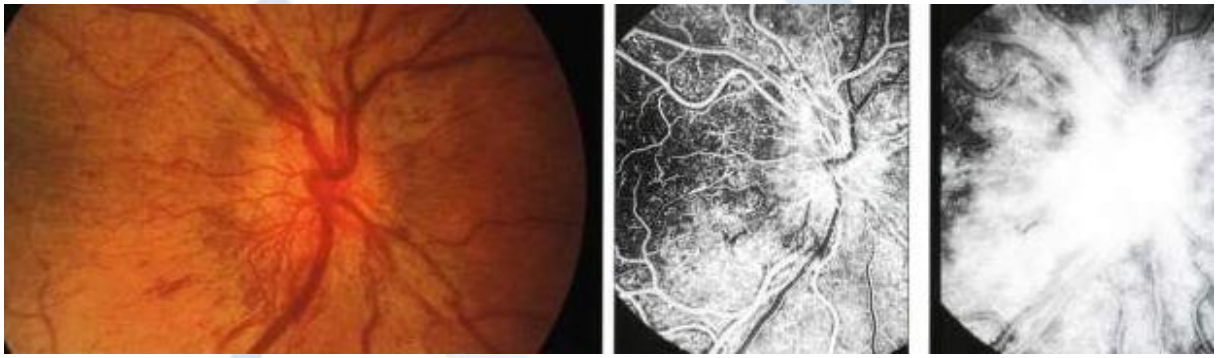


4-Proliferative retinopathy.

Abnormal neo-vascularization on the surface of the retina (NVE) and on the optic disc (NVD).

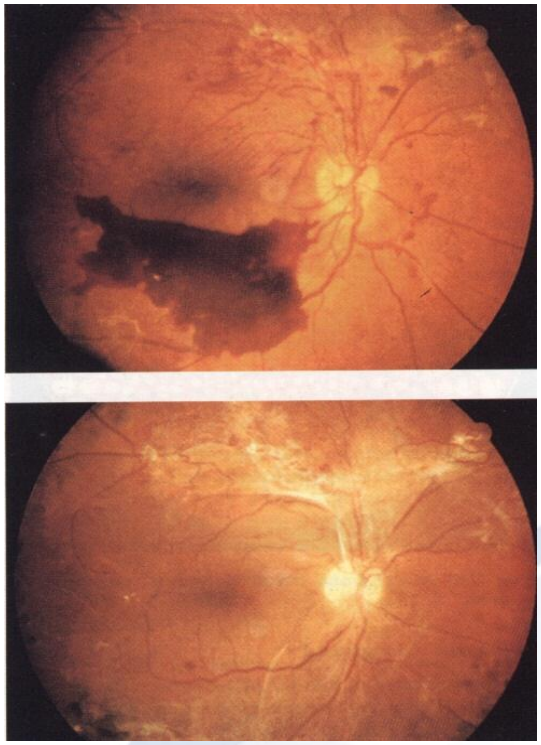


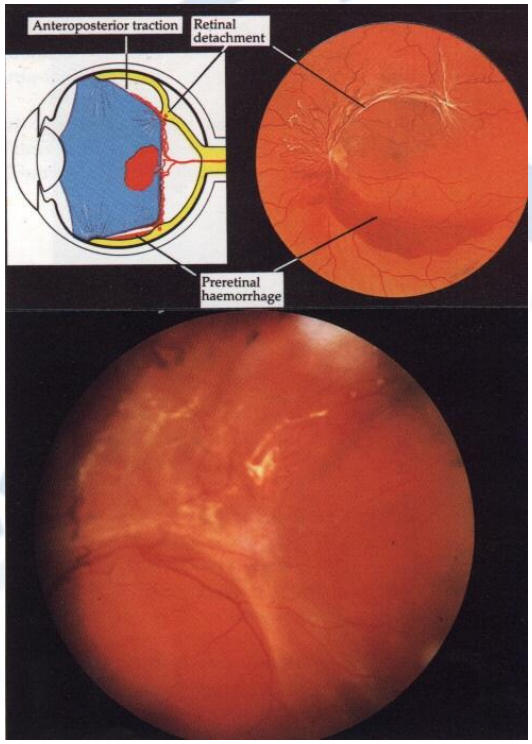


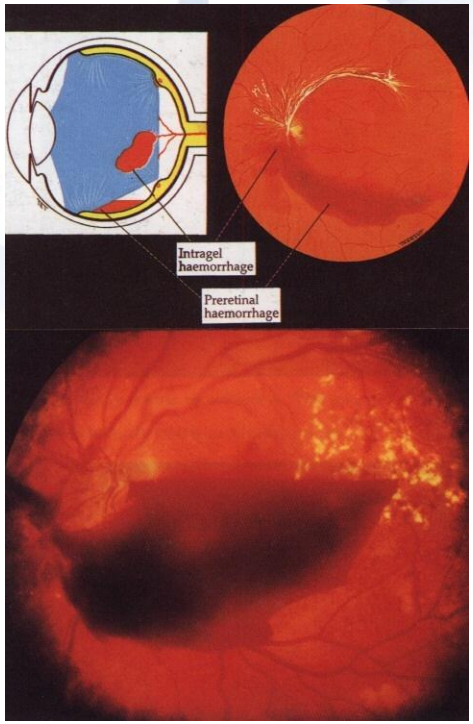


5-Advanced diabetic retinopathy.

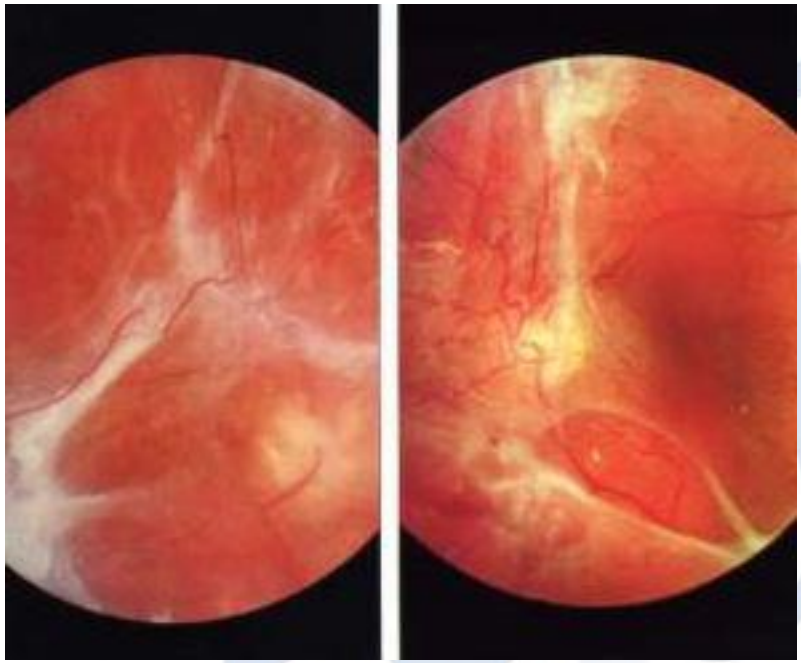
Vitreous hemorrhage and tractional retinal detachment.

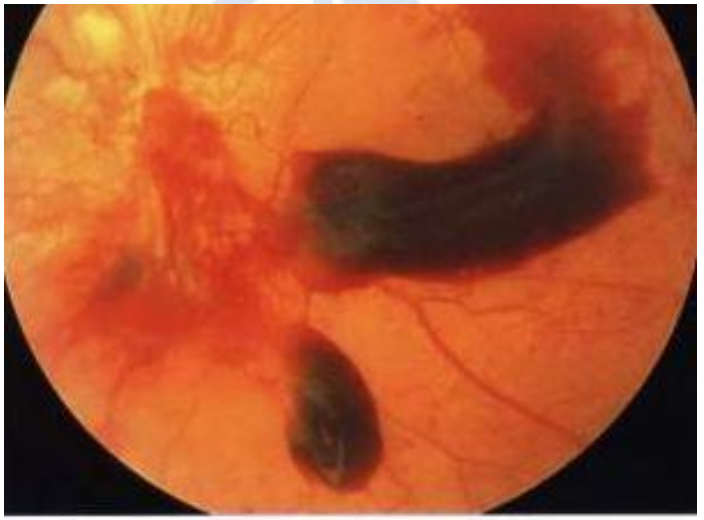


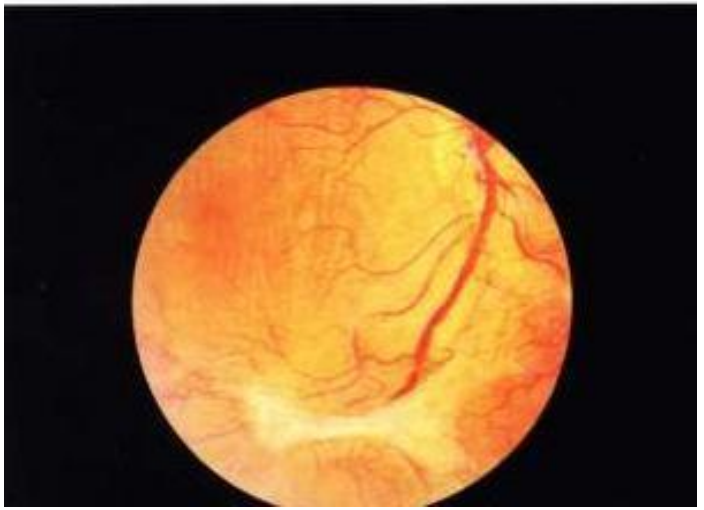




Advanced diabetic retinopathy







Management:

Essential Important Point is:

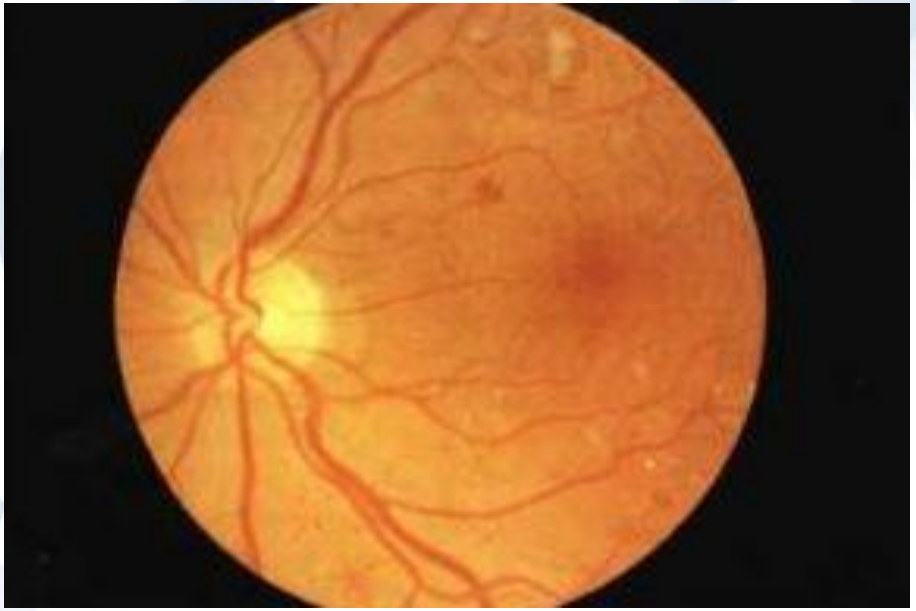
Early Detection of Diabetic Retinopathy

The treatment is more effective and the prognosis is better in early stages.

Every diabetic patient must has regular ophthalmic examination for detection retinopathy.

Background; good diabetic control

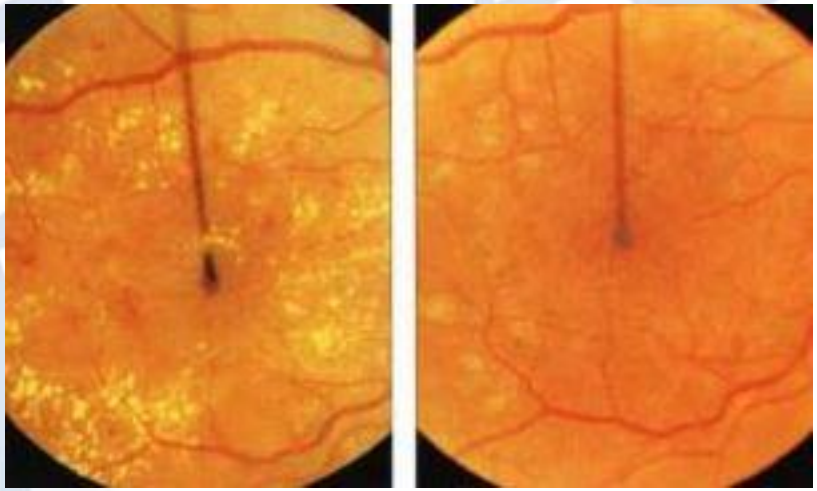
Control of other risk factors



Maculopathy:

Laser phototherapy.

Laser burns are directed at the sites of leakage (micro-aneurysms), avoiding the central fovea.



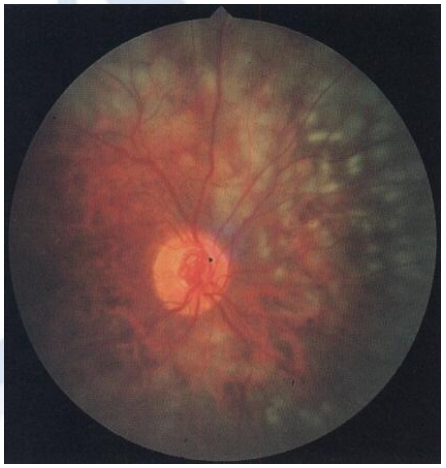
- Intra-vitreal injection of Anti-vascular endothelial growth factor (Anti-VGEF)

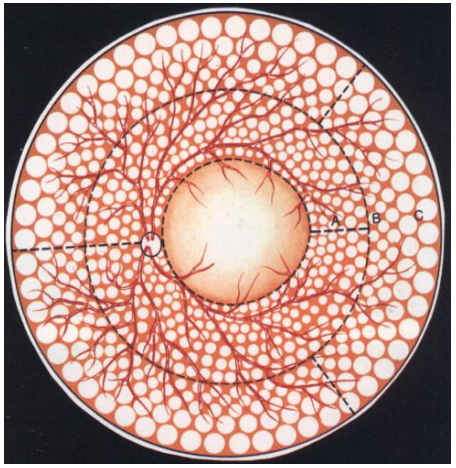
Pre-proliferative and Proliferative retinopathy;

Laser phototherapy.

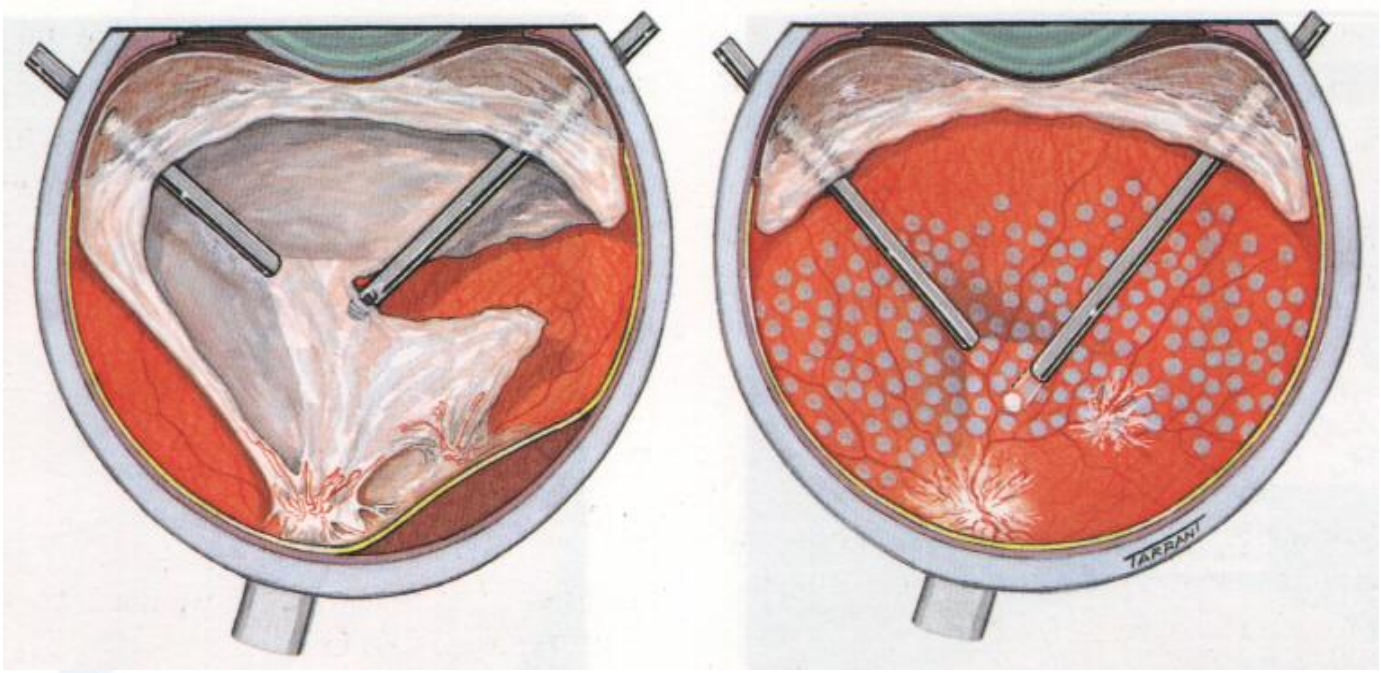
The entire retina is treated with laser burns except the macula and area adjacent to the optic disc Pan retinal photocoagulation (PRP).

The Laser burns destroy the ischemic retina and prevent release of vaso-formative factors and causing regression of the abnormal vessels.





Advanced retinopathy; Surgery (Pars Plana Vitrectomy). Removal of the vitreous hemorrhage, vitro-retinal bands and endo-laser through small incisions at pars plana (posterior part of the ciliary body).



Central retinal artery occlusion

Retinal arterial occlusion

Aetiology; Atherosclerosis, or Embolism

Symptoms: Sudden, painless loss of vision

Signs: Retinal edema, Cherry red spot

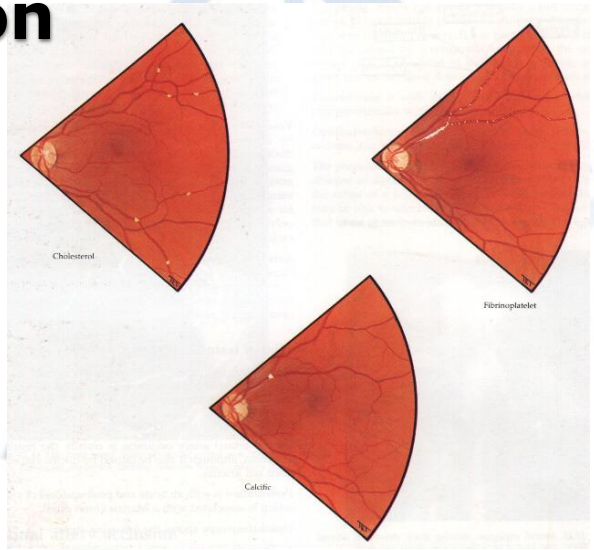
Old cases; atrophic retina, attenuated arterioles, and pale disc

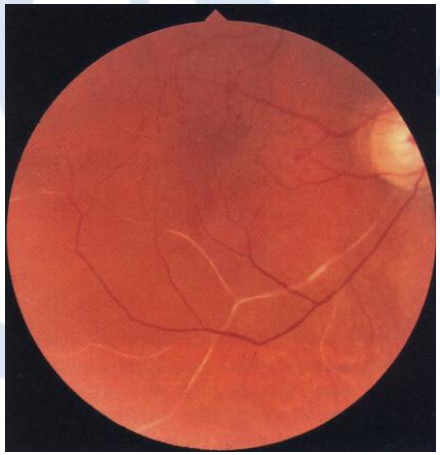
Treatment; must be given within 48 hours

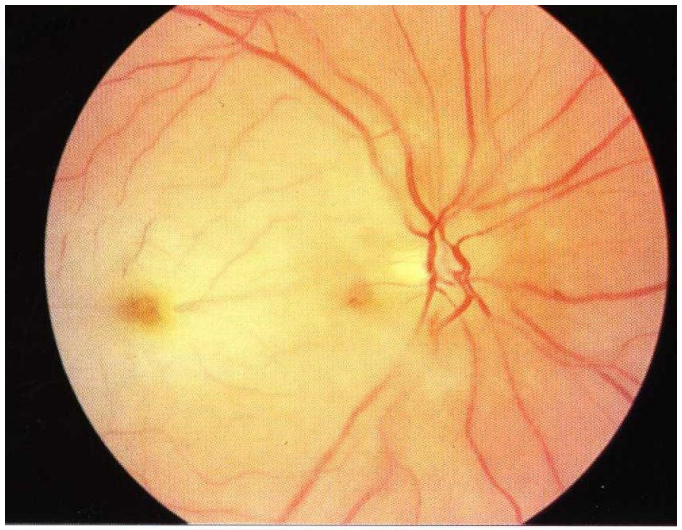
Ocular massage

Acetazolamide 500mg i.v.

Anterior chamber paracentesis

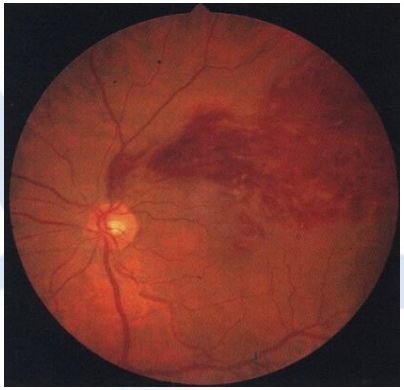


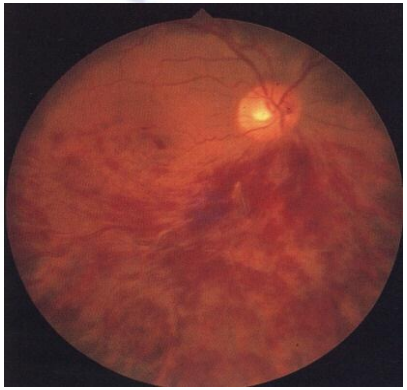




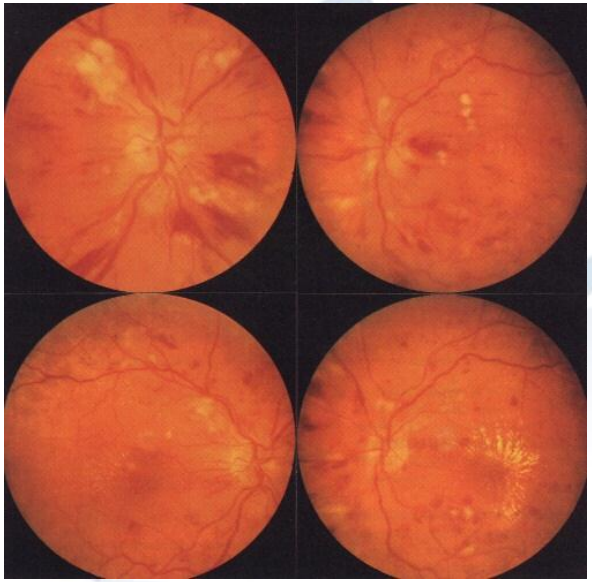
Central retinal vein occlusion

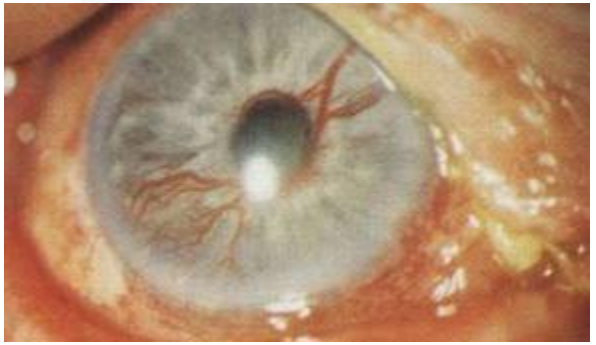
- Predisposing factors; Glaucoma, Hyper-viscosity of blood
- Symptoms: Sudden painless drop of vision
- Signs: Engorged retinal veins
  Retinal hemorrhage
- Cotton wool spots





- Complications of Retinal venous occlusion:
- - Chronic macular edema (cystoids macular edema)
- - Neo-vascular glaucoma (Rubeotic Glaucoma)
-
- Treatment: Intra-vitreal injection of Anti-vascular endothelial growth factor (Anti-VGEF) for treatment of Chronic macular edema.
- Laser therapy (PRP) for prevention of Neo-vascular glaucoma (Rubeotic Glaucoma)
-





Hypertensive retinopathy

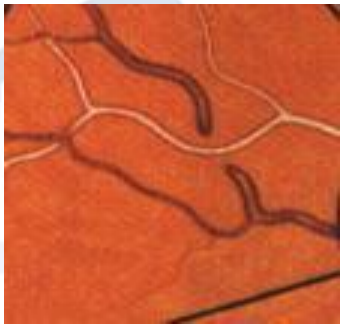
Hypertensive retinopathy depends on; age of the patient, pre-existing arteriosclerosis, severity and duration of hypertension.

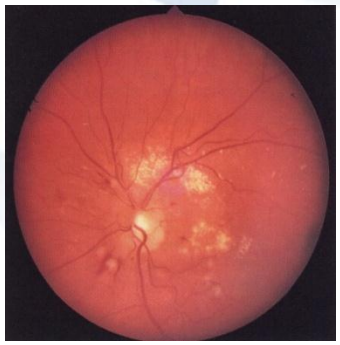
1-Narrowing of retinal arterioles, either focal or diffuse.

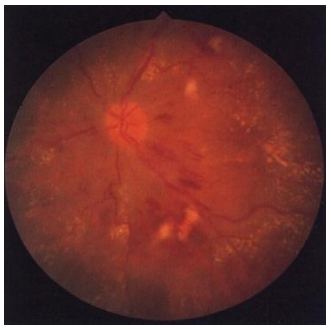
2- Artero-veinous crossing changes (nipping, concealment)

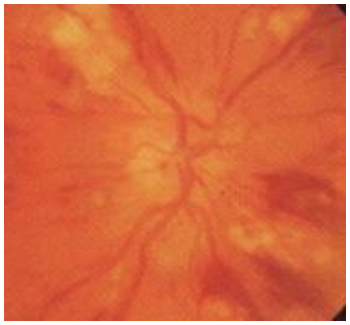
3-Retinal hemorrhage, hard exudates, and cotton-wool spots

4-Optic disc swelling in accelerated hypertension





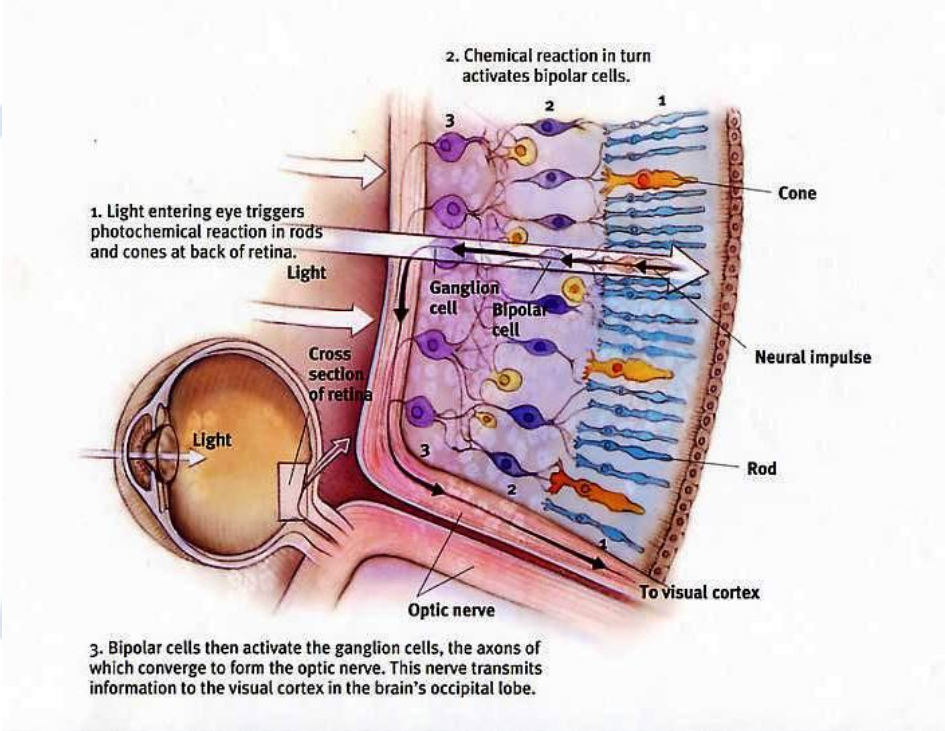




Retinal Detachment (RD)

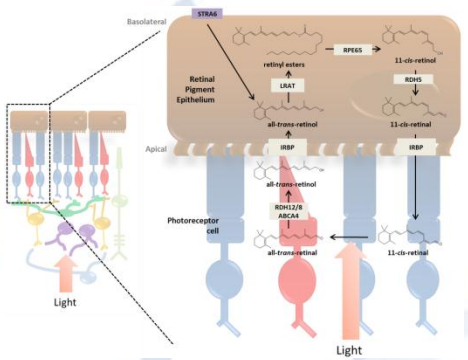
Retina consists of two main layers:

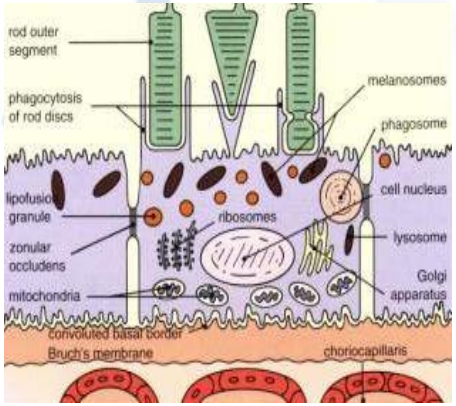
- A-The outer layer the Retinal pigment layer (RPE)
- B-The inner layer the Sensory layer,

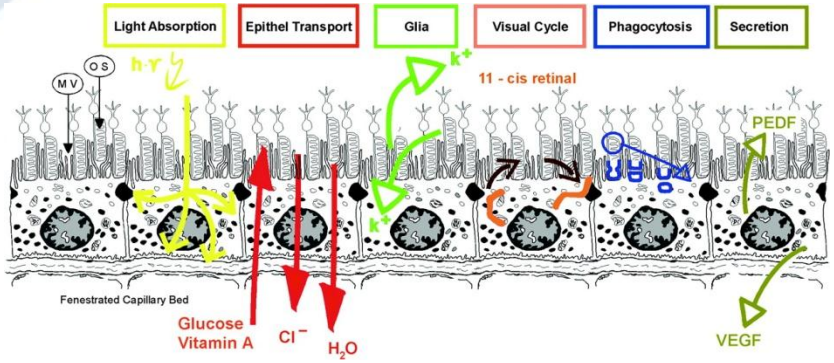


Retinal pigment epithelium

- Regenerates the visual pigments after phototransduction
- Passage of O_2 and nutrients from choroid to the photoreceptors
- Outer retinal blood barrier
- Absorb scattered light





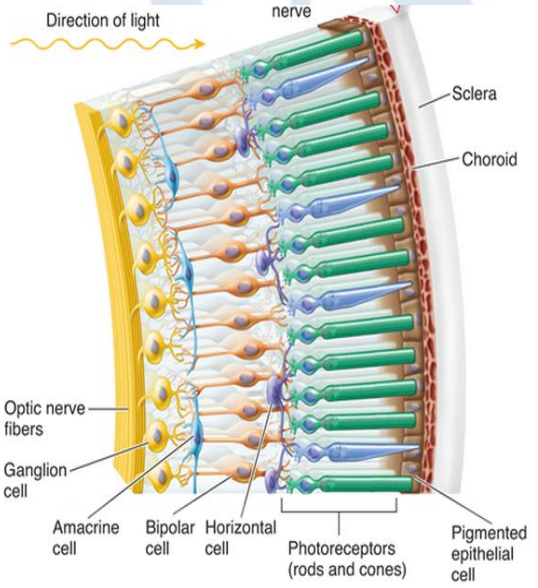


Attachment's factors are:

- Passive hydrostatic pressure

- Adhesive property of the inter-photoreceptors matrix

- Cushing effect of the jell-like vitreous



The vitreous:

a clear gel occupying two-thirds of the globe.

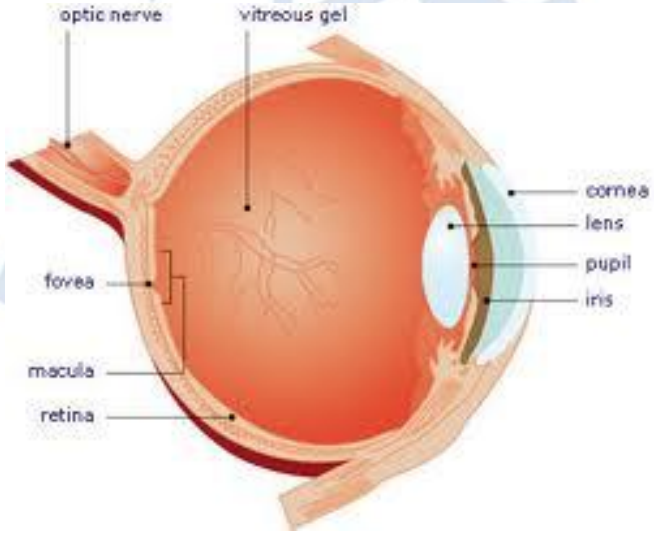
98% water.

The remainder consists of hyaluronic acid and a fine collagen network.There are few cells.

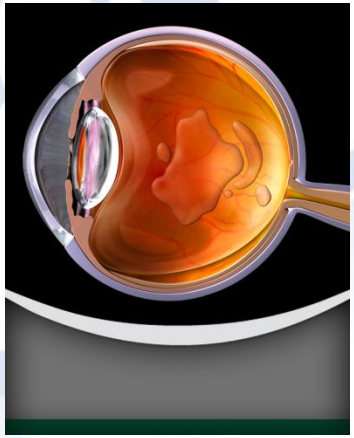
Attached firmly at:

the peripheral retina (ora serrata), and around the optic disc (Wiess ring)

.



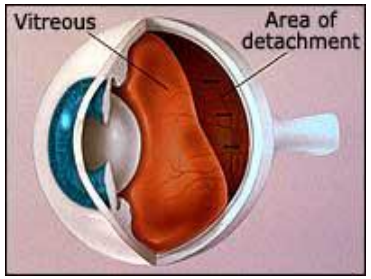
Liquification of vitreous



- Degenerative process occurs in elderly
- Post-traumatic
- High myopia
- Vitreo-retinal dystrophies

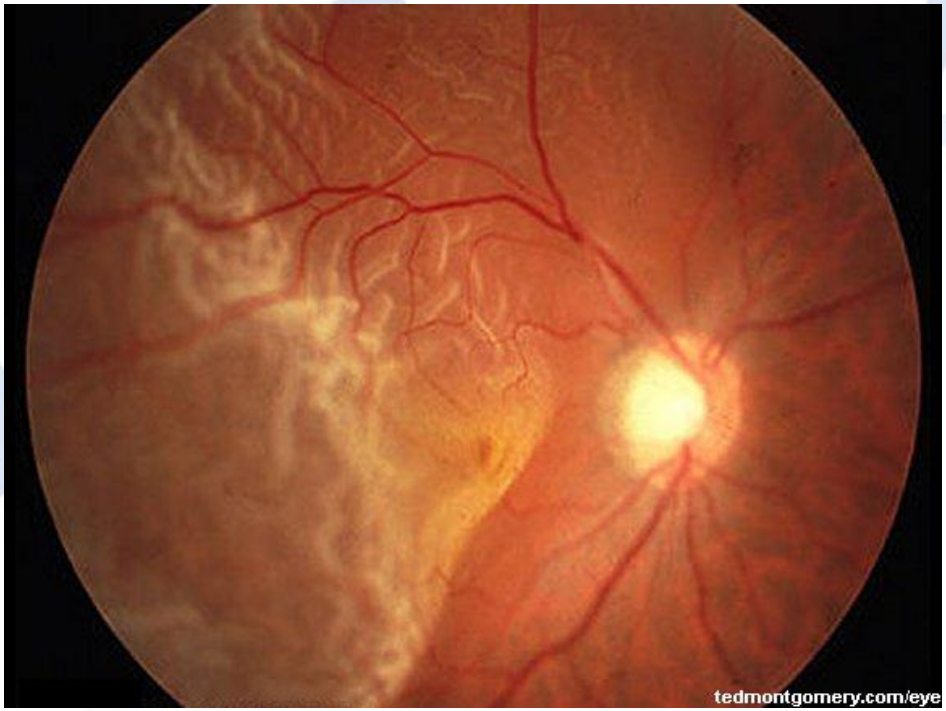
- **Posterior vitreous Detachment (PVD)**

  Separation of the posterior vitreous face from the surface of the retina
- Asymptomatic (Majority)
- Floaters and photopsia (sometimes)
- May predispose to retinal detachment (rarely)



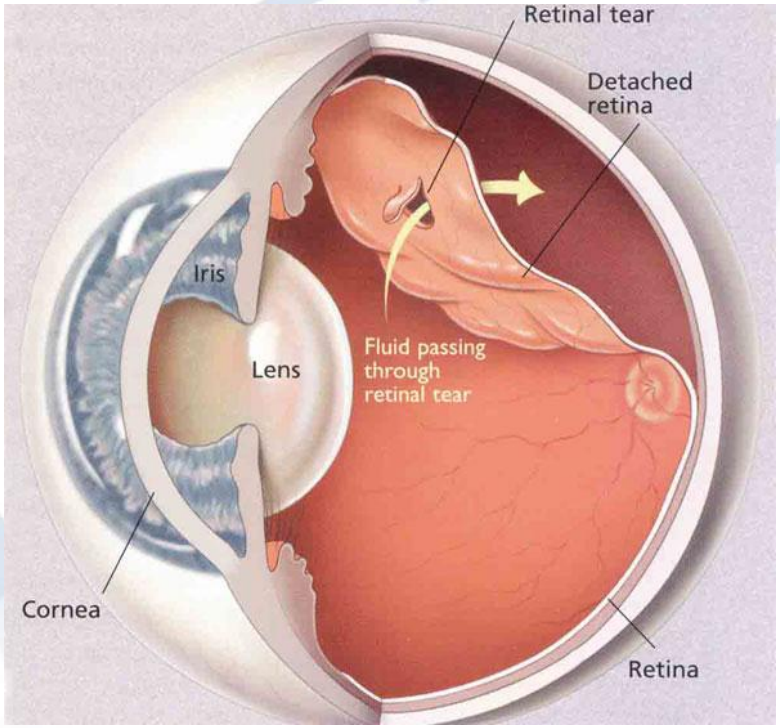
- Retinal Detachment (RD)

  Separation of the sensory retina from the RPE



- **Rhegmatogenous R.D.**

  is separation of the sensory retina from the RPE by subretinal fluid derived from liquefied vitreous pass through full thickness break in the sensory retina.



Predisposing factors:

- A- Vitreous liquefaction

- Degenerative process occurs in elderly
- Post-traumatic
- High myopia
- Vitreo-retinal dystrophies

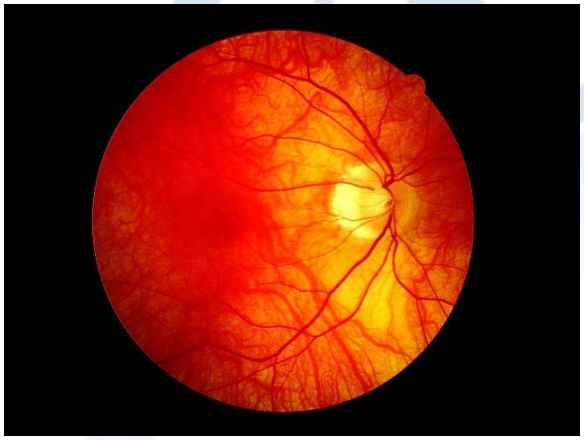
- B- Retinal break

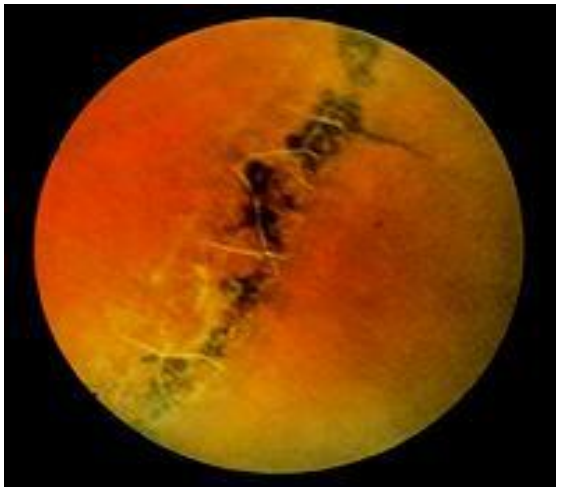
a-Underlying retinal weakness

-Diffuse retinal thinning in high myopia.

-Localized retinal thinning

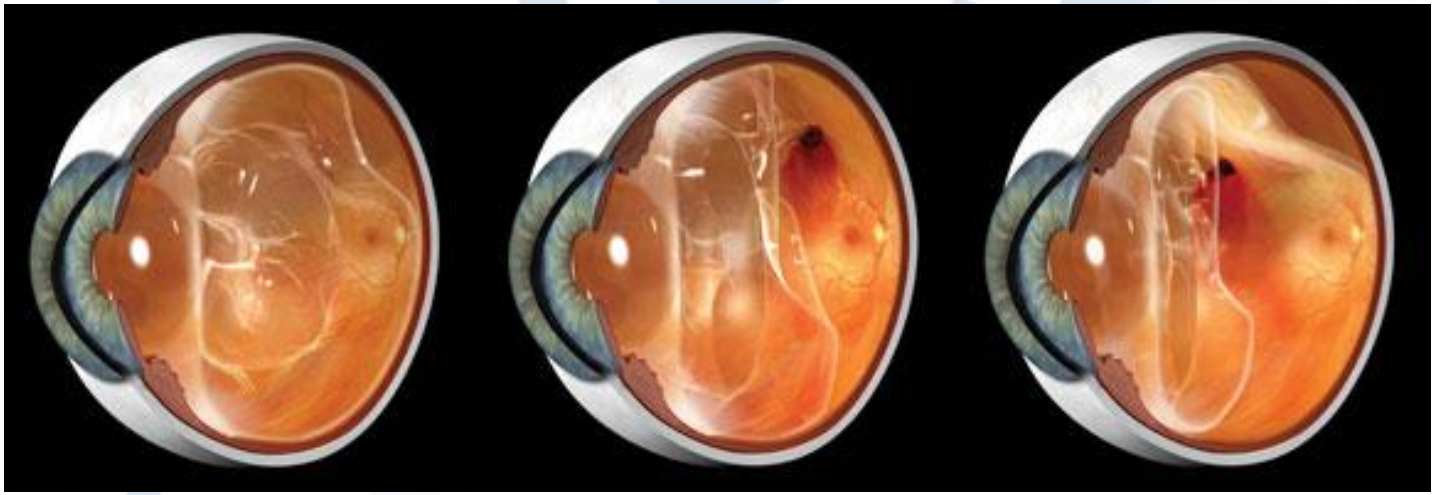
e.g. Lattice, Snail tract degeneration (developmental spindle shape thinning in the peripheral retina),

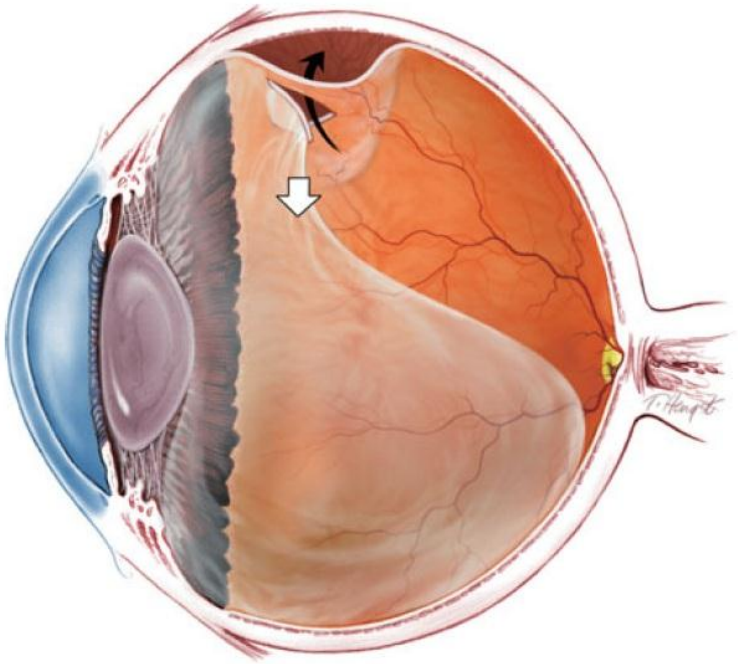


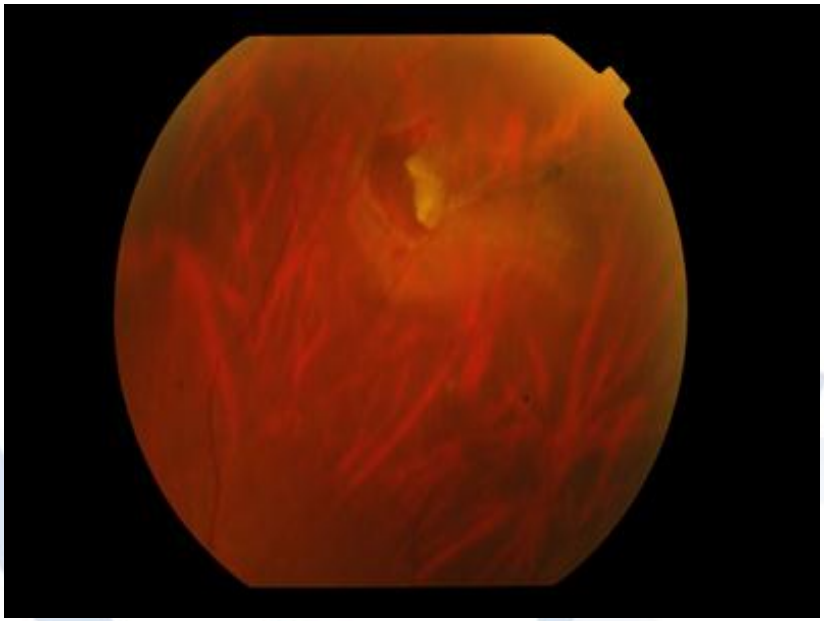


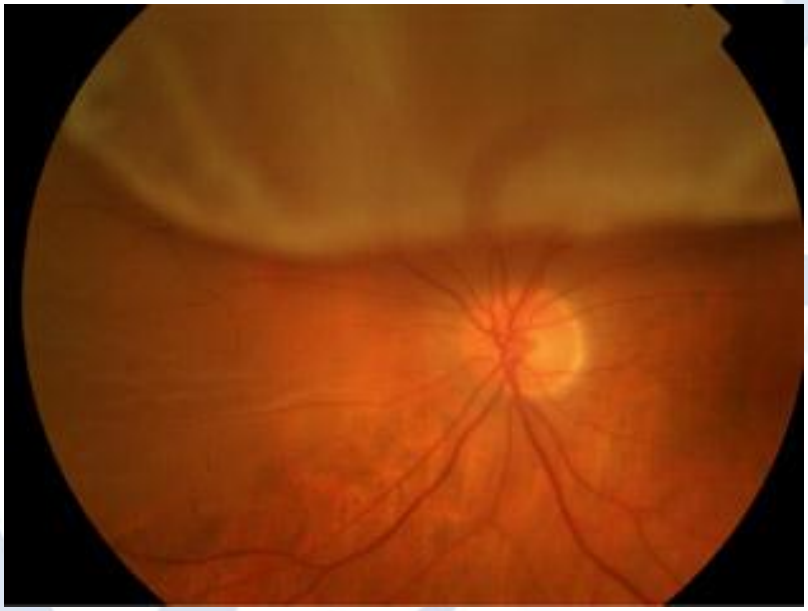
b-Posterior vitreous Detachment (PVD) with abnormal vitre-retinal adhesions

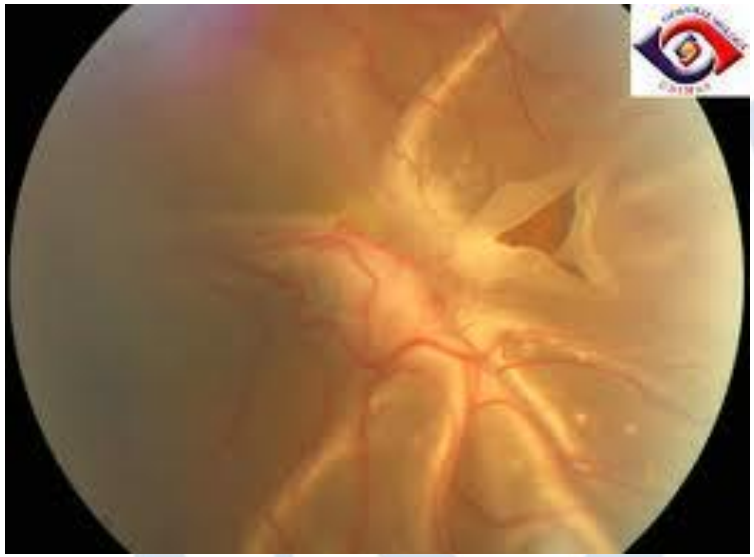
may predispose to retinal break

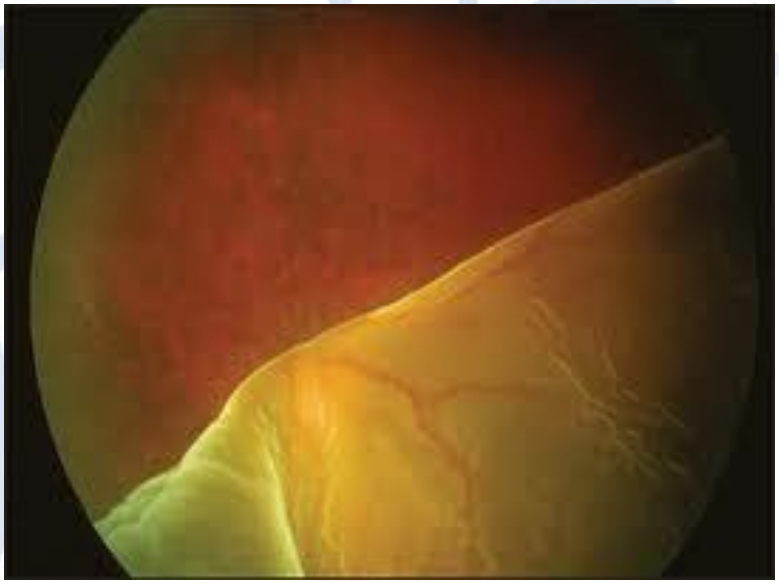












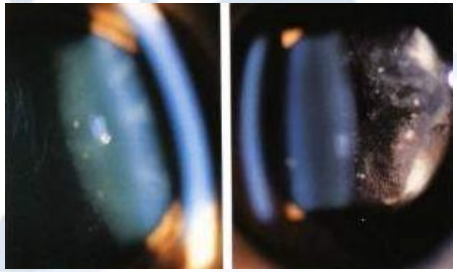
Clinical features:

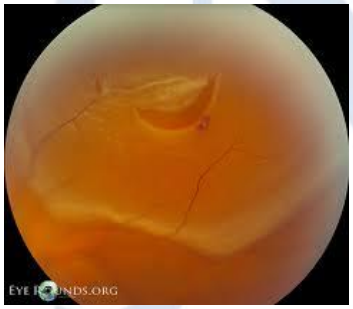
Symptoms

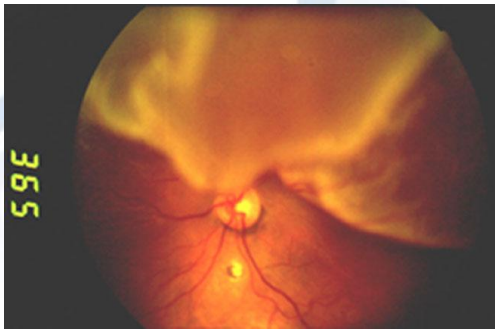
- 1-Painless drop of vision
- 2-Visual field defect
- 3-Photopsia (perception of flashes of light)
- 4- Floaters (perception of moving images in the field of vision, caused by vitreous opacities that cast a shadow on the retina)

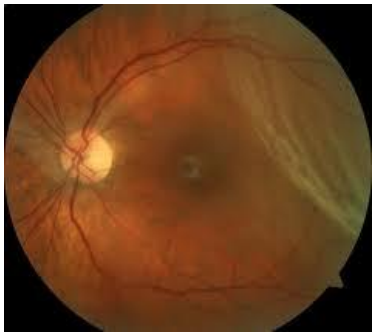
Signs

- 1-Depressed Visual acuity
- 2-Impairment of Pupillary light reflex
- 3-Vitreous opacities
- - Pigment cells (Tobacco dust)
- 4-Abnormal position, elevated retina with corrugated surface.
- 5- Retinal break







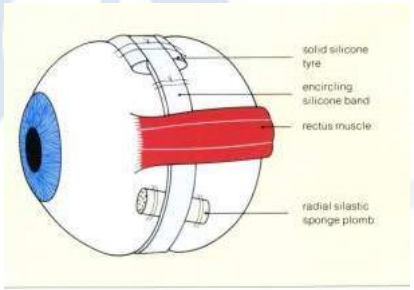


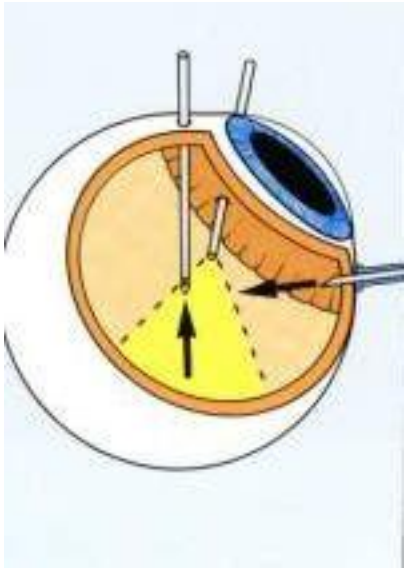
Treatment is surgery:

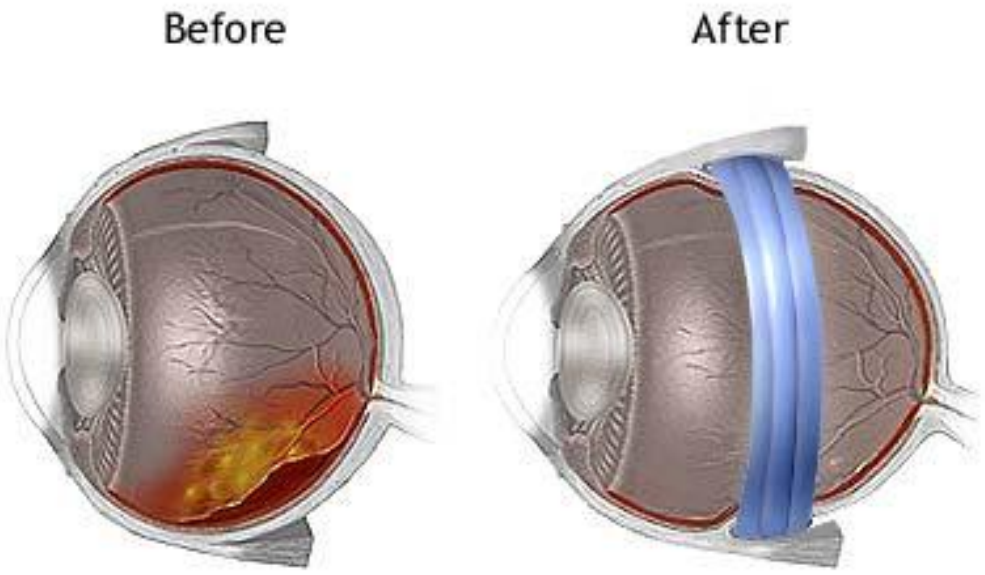
- Repositioning of sensory retina over the RPE
- Drainage of sub-retinal fluid
- Sealing of retinal break(s).

- Procedures for management of R.R.D.

- Scleral Buckling, for fresh detachment
- Pars Plana Vitrectomy, for long standing R.D.

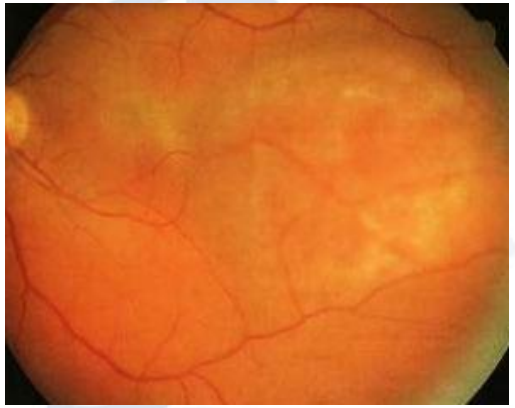


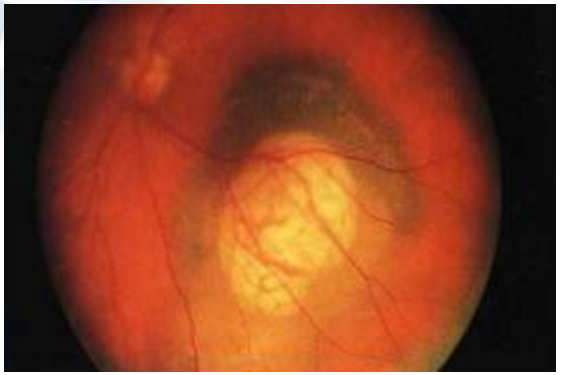




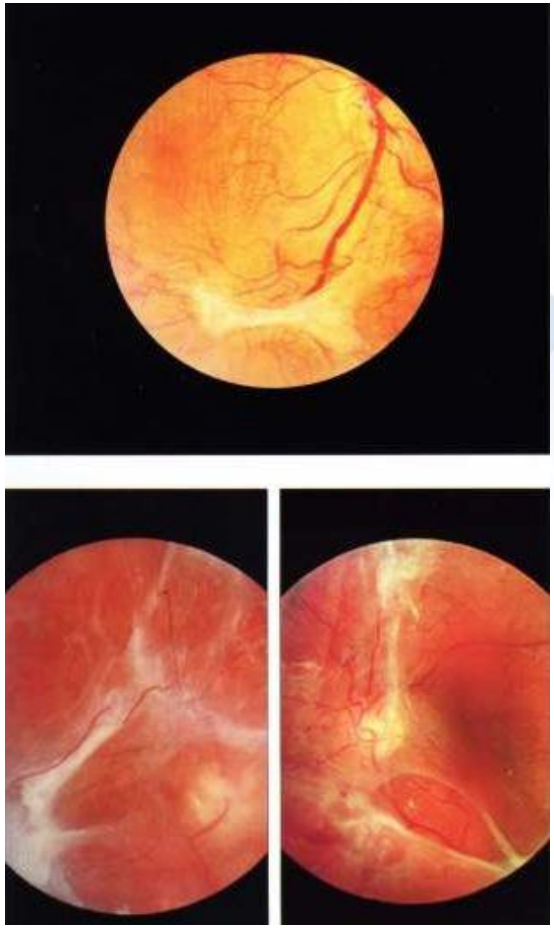
- **Exudative RD**

- Separation of the sensory retina from the RPE by subretinal fluid derived from the choroid.
- Causes
- A- Choroditis
- B- Tumors e.g malignant melanoma of the choroid





- **Tractional RD**
- Separation of the sensory retina from the RPE due to contractions of vitreo-retinal membranes
- Causes
- Perforated eye trauma
- Advanced diabetic retinopathy



Macular Disorders

Age related macula degeneration

Formation of abnormal neo-vessels derived from the choroid pass under the sensory retina at the macular region.

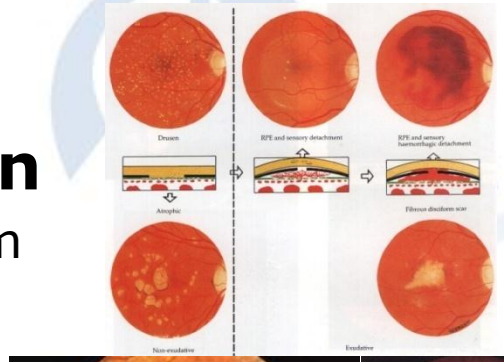
Complications

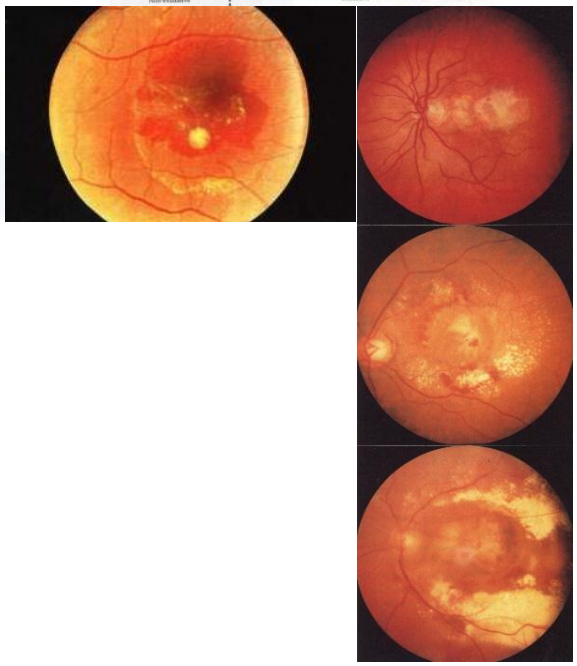
- Retinal and subretinal hemorrhage
- subretinal fibrosis

Onset after age 50 years with gradual painless drop of central vision.

Treatment

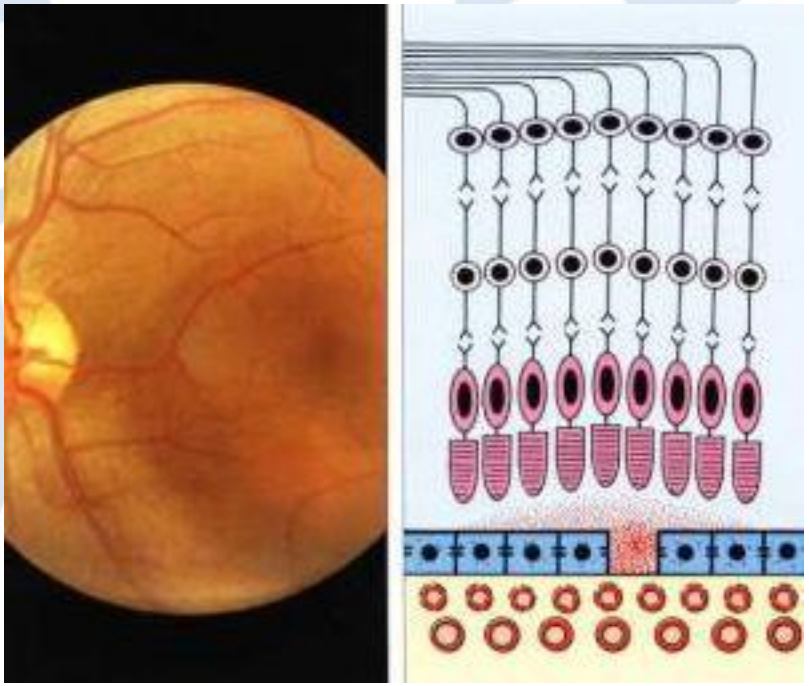
Intra-vitral injection of Anti-VEGF





Central serous retinopathy (CSR)

- Idiopathic serous detachment of the sensory retina at the macula
- Clinical features:
- Young adults
- Painless drop of central vision
- Treatment:
- Spontaneous recovery in the majority of cases within 6 months.
- Laser therapy in resistant cases

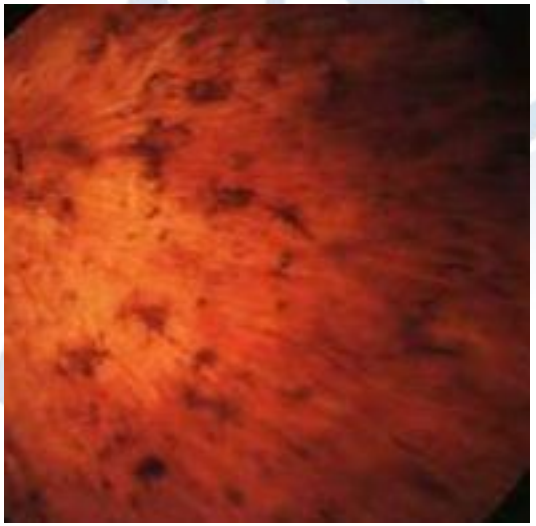


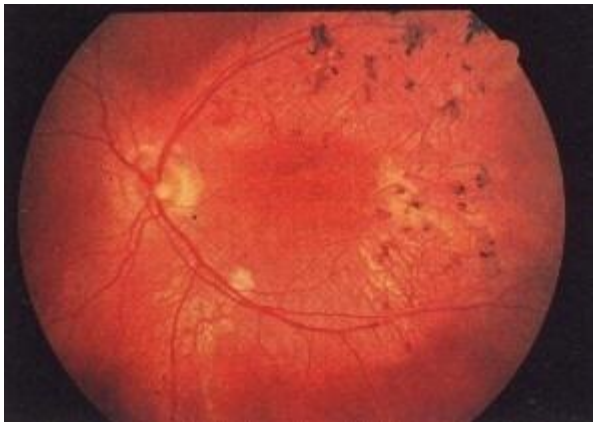
Congenital and developmental abnormalities

Retinitis pigmentosa

- Hereditary
- Bilateral

- Clinical features:
- Night blindness, constriction of visual field, and drop of central vision
- Retina; Bone-specules pigmentation
- Attenuated blood vessels
- Waxy pale disc



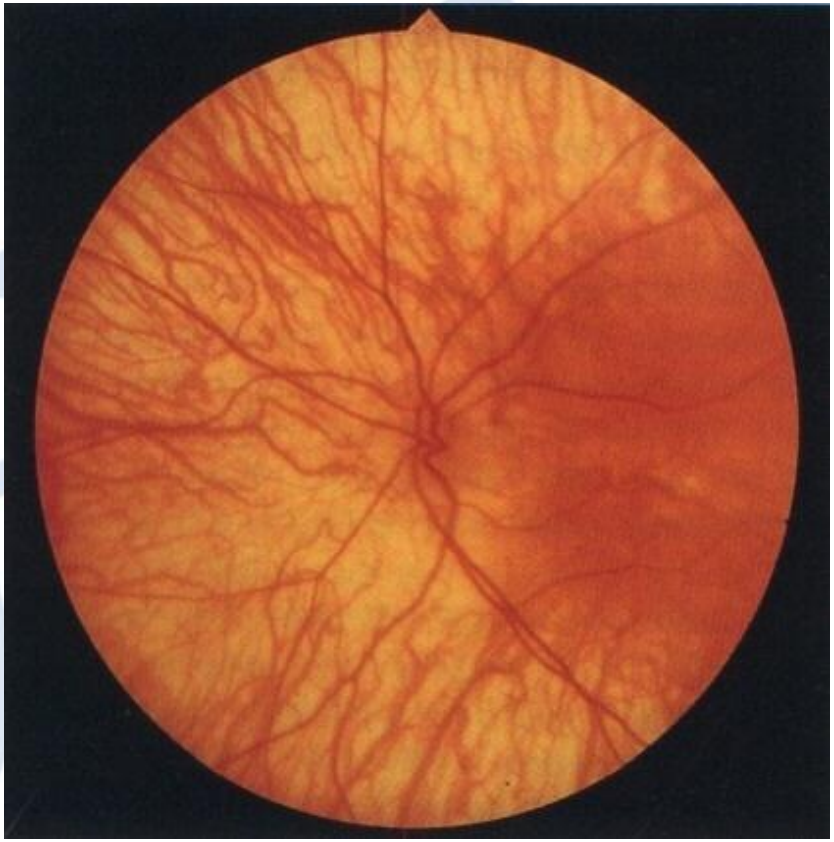


Albinism

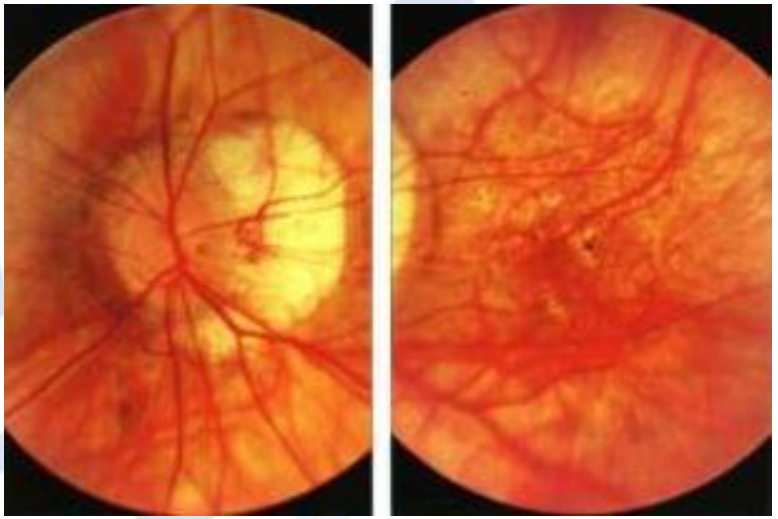
- Inborn error of metabolism of melanin
- Tyrosinase enzyme deficiency

- Ocular or oculo-cutaneous

- Bilateral
- Poor vision,
- Photophobia
- Nystagmus (bilateral involuntary rhythmical oscillation of the eyes)
- Absence of pigmentation in the iris choroid and RPE



- **Degenerative Myopia**
- Autosomal recessive
- Manifested early in life
  Rapidly progressive during puberty



- **Clinical features**
- **Symptoms**;
- Blurring of distant image

- **Signs:**

-Large eye, large cornea and deep anterior chamber
- Sublaxated lens
- Higher prevalence of primary open angle glaucoma
- The entire retina appears attenuated
- Patches of choro-retinal atrophy
- Optic disc is large with myopic crescent
- Retinal degeneration predisposed for retinal breaks and rhegmatogenous retinal detachment.

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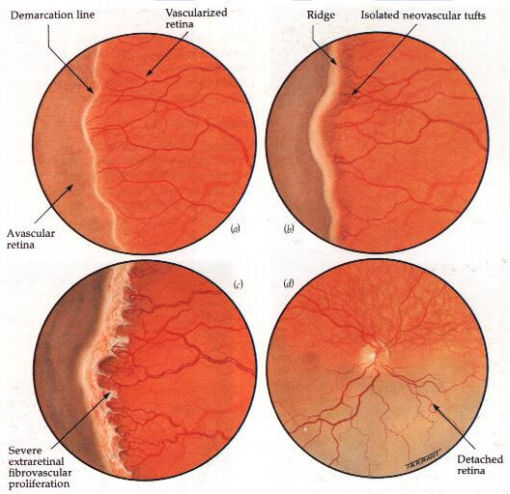
Retinopathy of premature

- Risk factors;

1- Gestation less than 32 weeks
2- Birth weight below 1500 gm
3- Exposure to supplemental oxygen



- Signs

Abnormal retinal new vascularization
Retinal and vitreous hemorrhage
Tractional retinal detachment

Retinoblastoma

- The most common primary ocular tumors
- Usually presented before age 2 years
- Mode of presentation:

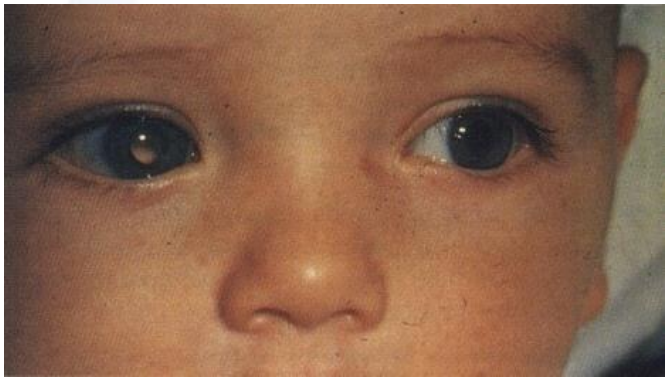
-Leukocorea ; white pupil

-Proptosis; protrusion of the eye-ball

-Pseudo-hypopyon

-Squint

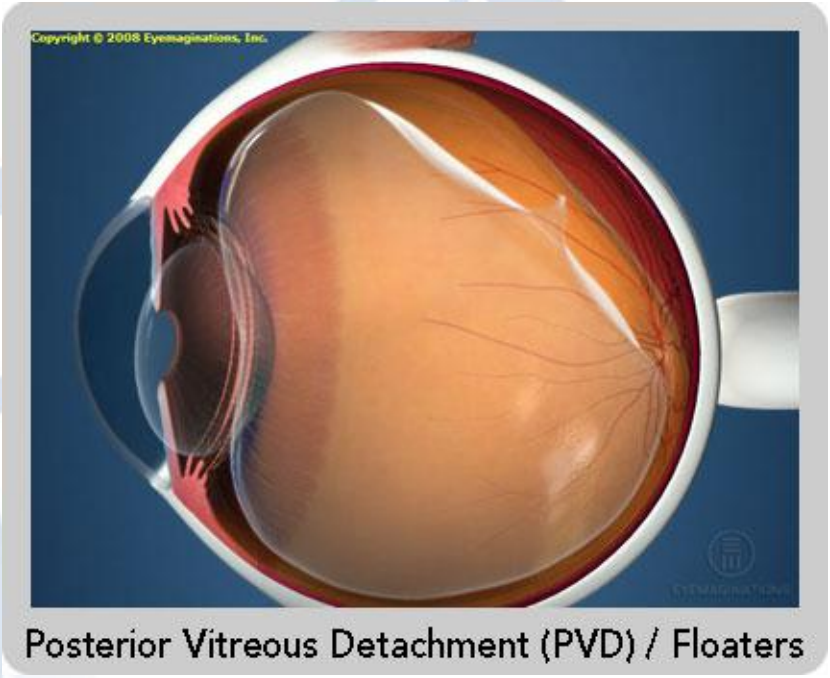
-Secondary glaucoma



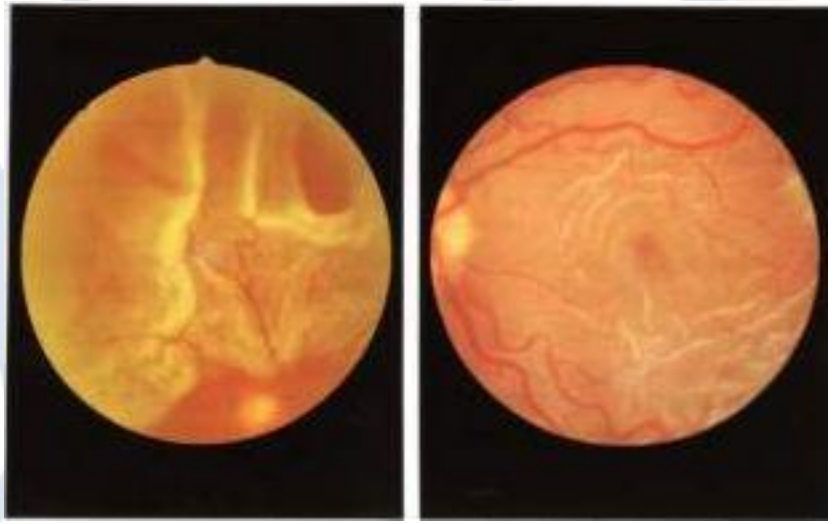
- Treatment
- Laser photo-destruction for small lesions,
- Enoculation (removal of the eye-ball) for large tumors
- Chemotherapy

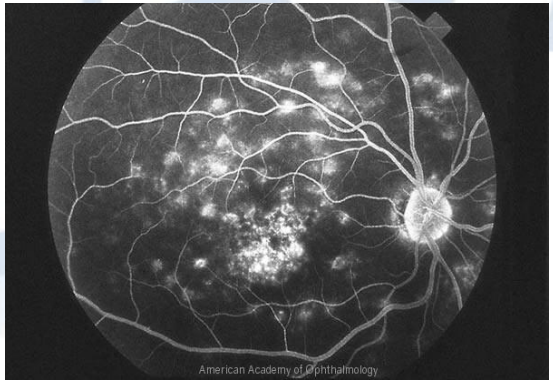
Retinal break

b- Posterior vitreous detachment- PVD causes traction over areas of abnormal vitreo-retinal adhesions. This may lead to a peripheral retinal break, when the vitreous pulls away a piece of the underlying retina



Posterior Vitreous Detachment (PVD) / Floaters

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