

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI  
SCHOOL OF HEALTH TECHNOLOGY(SOHT)  
15<sup>TH</sup> SOHT LECTURE SERIES

# **GLAUCOMA, A GLOBAL CHALLENGE TO VISION: SCREENING, EARLY DETECTION & MANAGEMENT**

**By**

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Glaucoma, a global challenge to vision: screening, early detection and management by Okorie, M. E. is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

# PRESENTATION OUTLINE

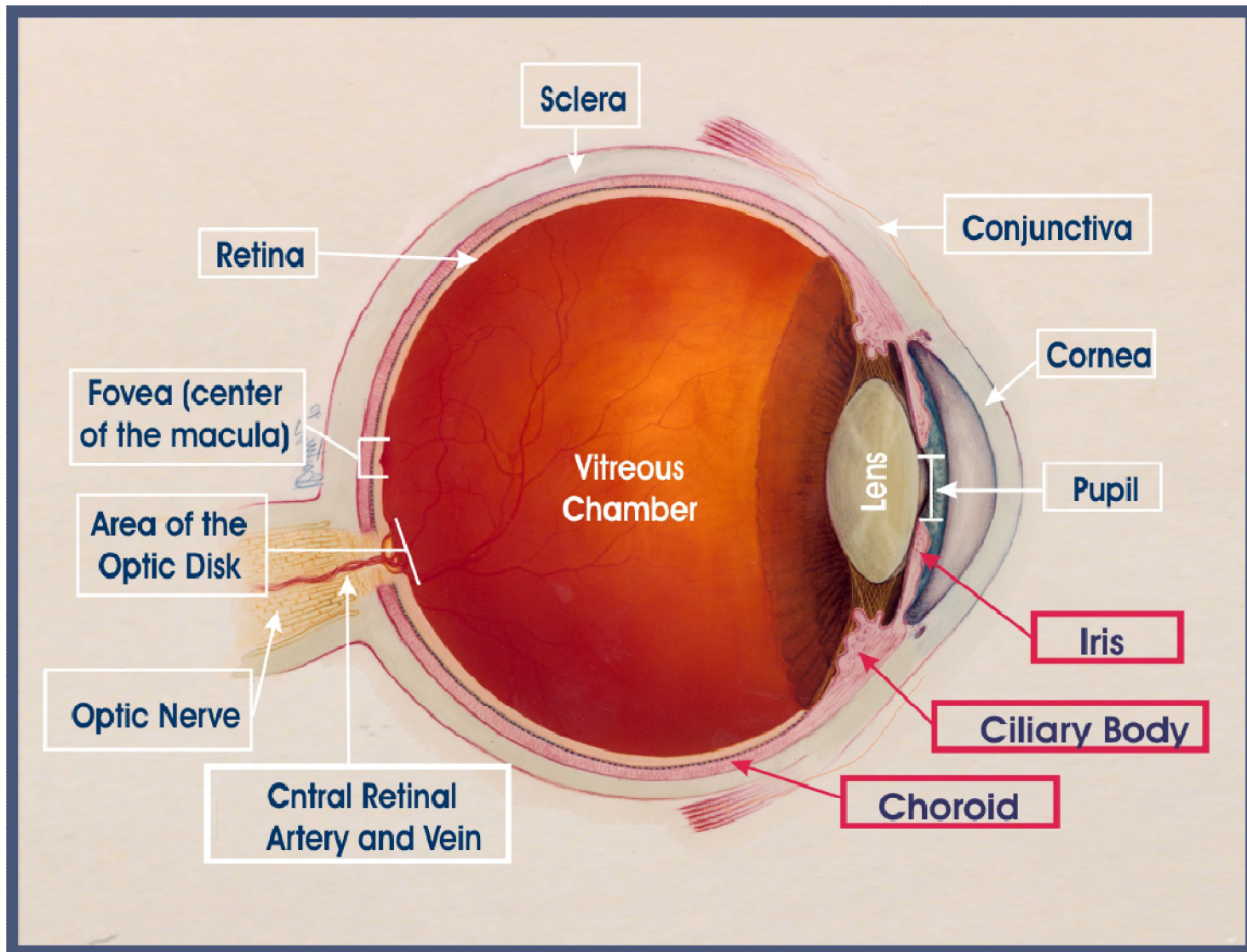
- Protocol
- Preamble
- Introduction
- What is Glaucoma?
- Classification, pathophysiology, clinical signs
- Epidemiology: Screening/Early detection
- Therapeutic & Surgical management

## ABSTRACT

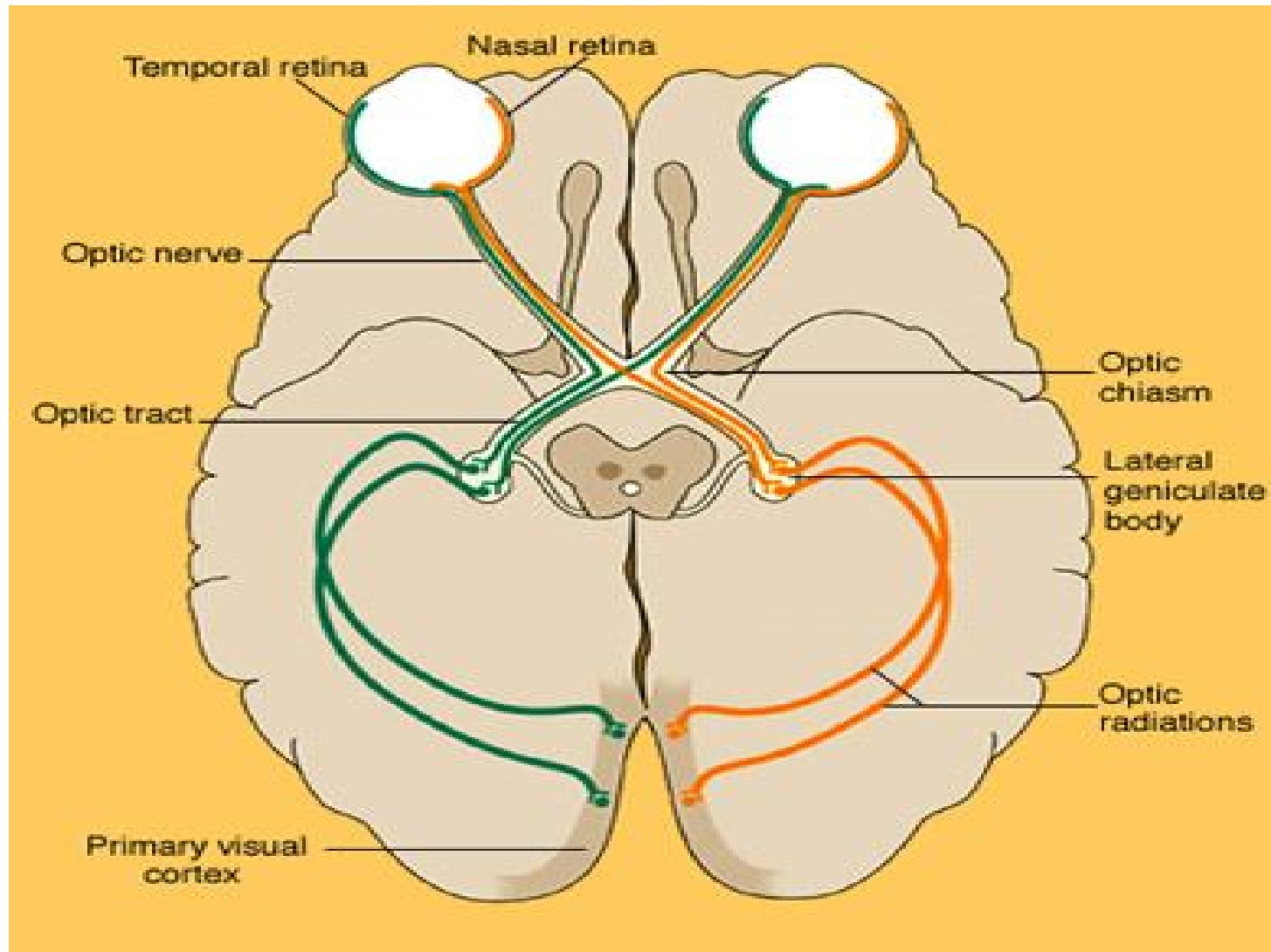
- Although the burden of visual impairment and blindness due to the glaucoma eye disease have been increasing worldwide, the level of awareness of the general population about its solution and the utilization of eye health care services are low. This lecture attempts to provide illumination and co-opt health educators on the issue of glaucoma, its magnitude, and those at risk. It emphasizes on what needs to be done for its control, such as screening, early detection and treatment.

# INTRODUCTION

The eye is the most important of the body's sensory organs consisting of several different tissues which, in association with the nervous system, provides us with one of the most important of God's precious gifts to man- Sight or Vision



Structural components of the Eye



The Visual Pathway

- **Vision** or **seeing** is a learned behavior that refers to the ability of an individual to associate **visual sensations** aroused in the nervous system with their external sources.

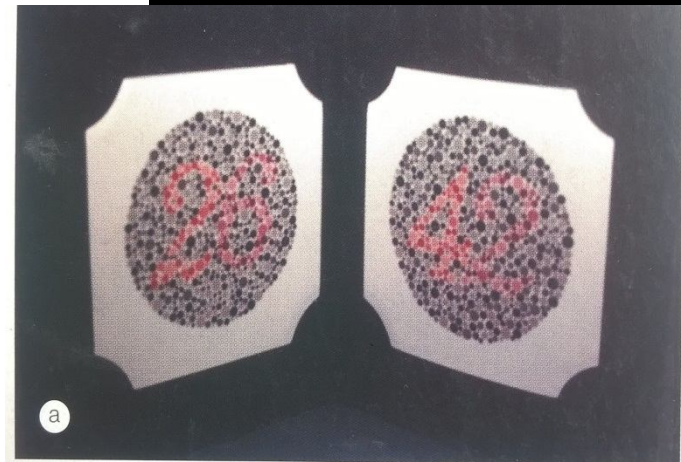
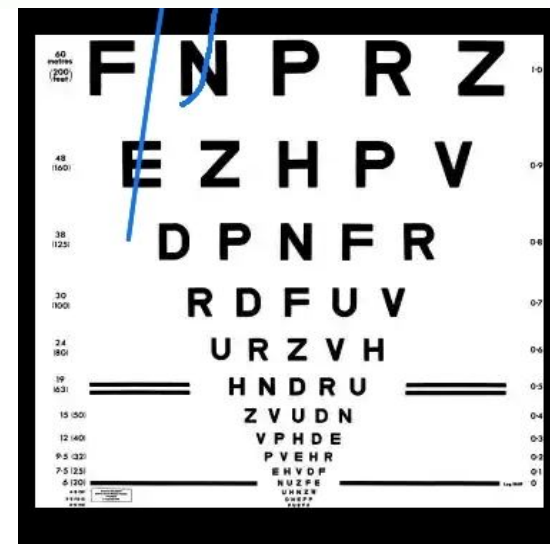
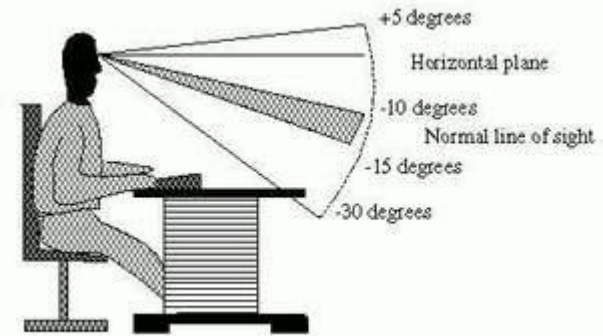
- A **sensation** is a change in state of consciousness by which we appreciate any alteration caused by external or internal stimuli(light, color, sound, a taste, hunger, etc.,) without associating it with any internal or external causes (**Emsley, 1953**)



- This implies that although new born infants experience visual sensations, **vision** is abnormal but develops to the normal state at maturity(5-6 years) with continuous stimulation and is subject to threats occasioned by **inherited, developmental, and acquired diseases.**

# Forms of vision

- ✓ Light perception
- ✓ Field of vision
- ✓ Form vision
- ✓ Color vision
- ✓ Contrast sensitivity
- ✓ Depth perception, etc.



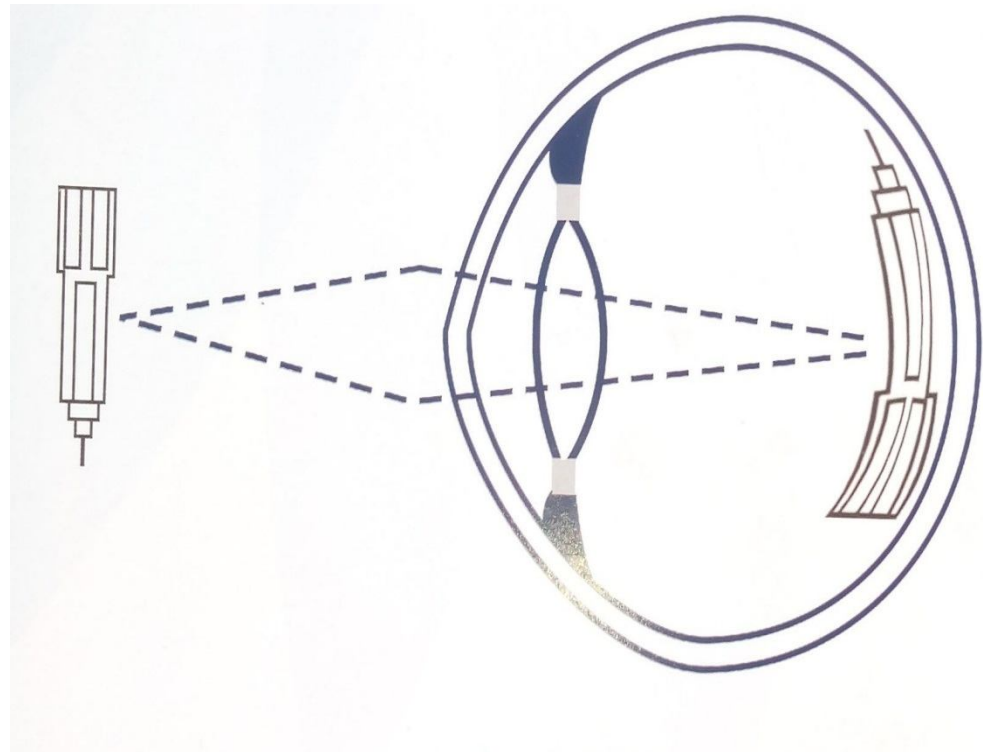
# **Processes of Vision**

- Physical process
- Physiological process
- Psychological process

# The physical process of vision

## Light

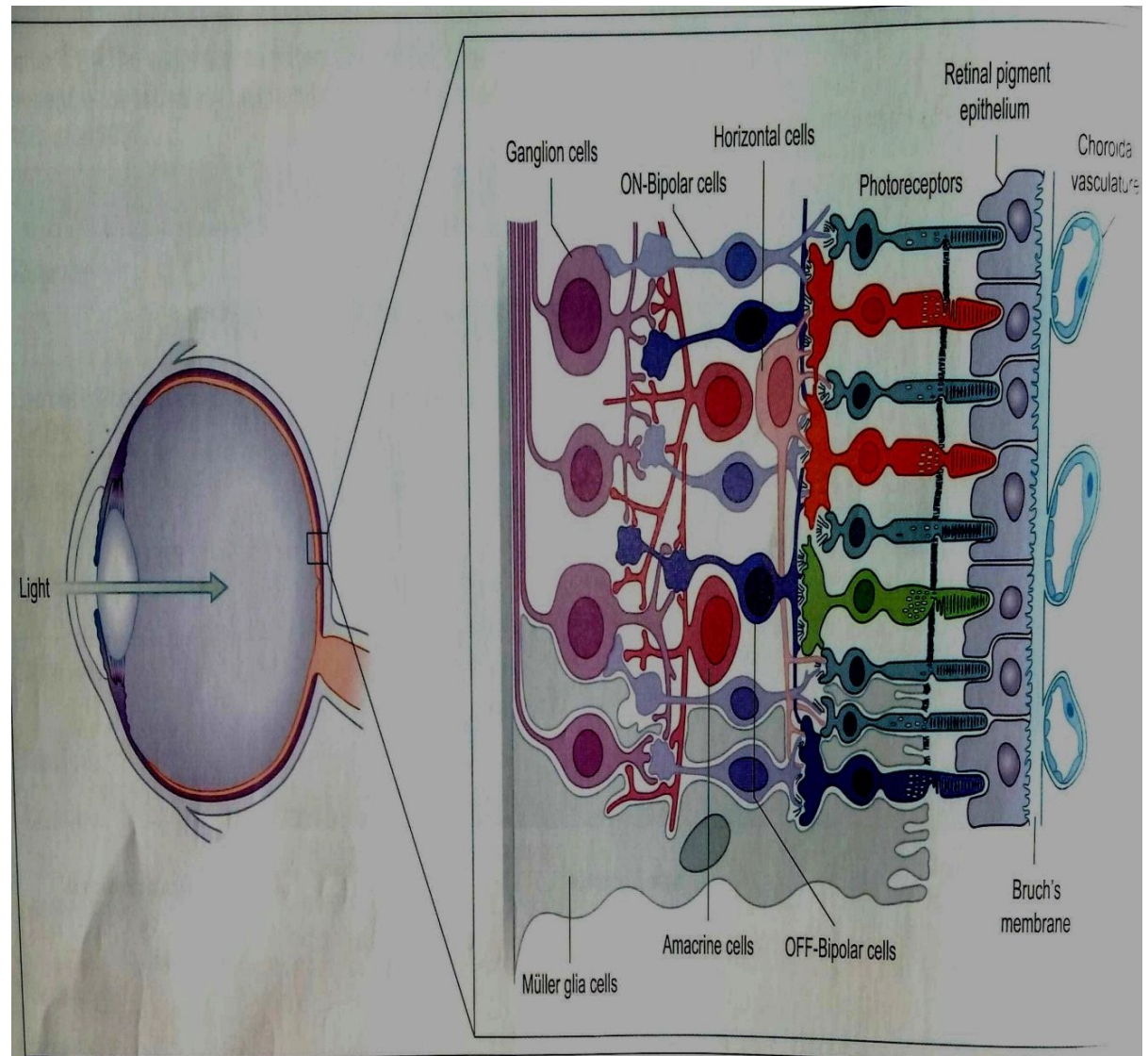
- Reflection
- Transmission
- Refraction
- Retinal image formation



# Physiological process of vision

## Light

- ✓ Absorption
- ✓ Transduction
- ✓ Processing
- ✓ Transmission to brain cause visual sensation



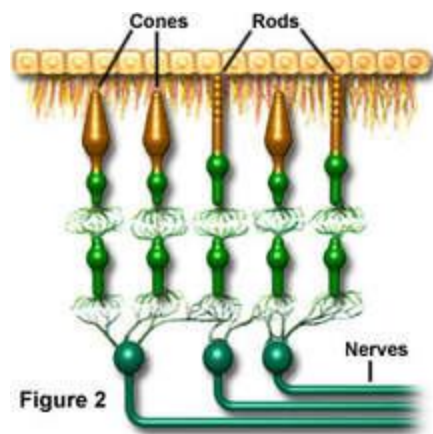
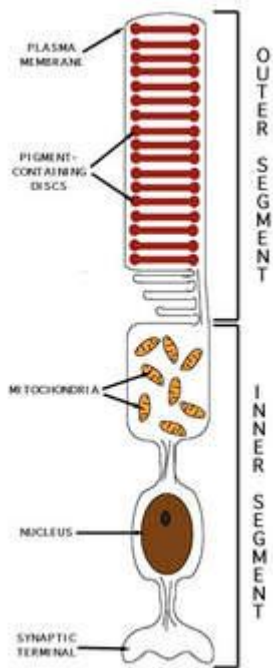
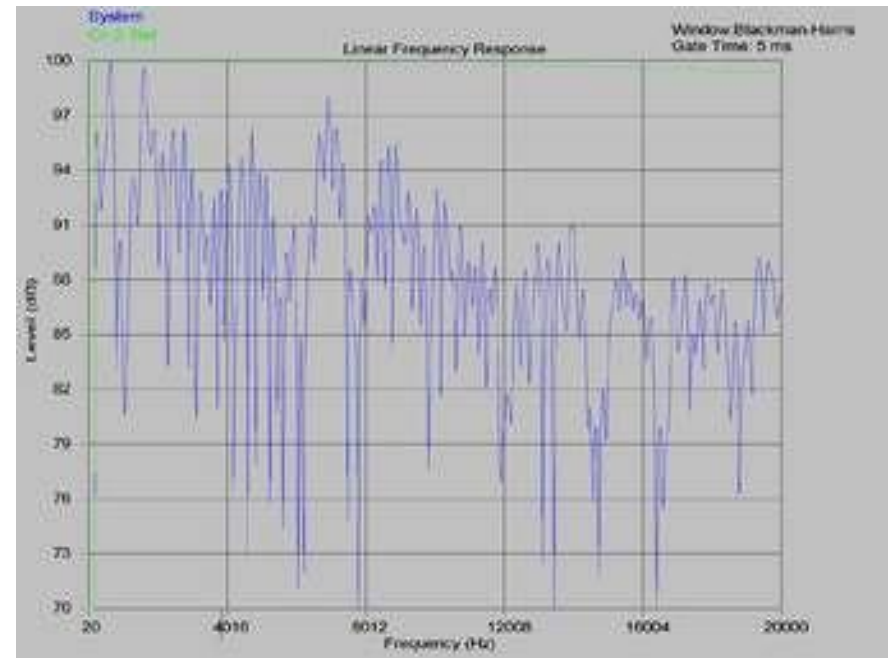


Figure 2



Retinal neurons in photo-transduction

The optic nerve is an afferent nerve that continuously send visual information to the CNS, leading to a visual sensation.



The Optic Nerve: A part of the CNS

# The psychological process of vision

## Visual Sensation

- processing
- Interpretation
- Visual perception

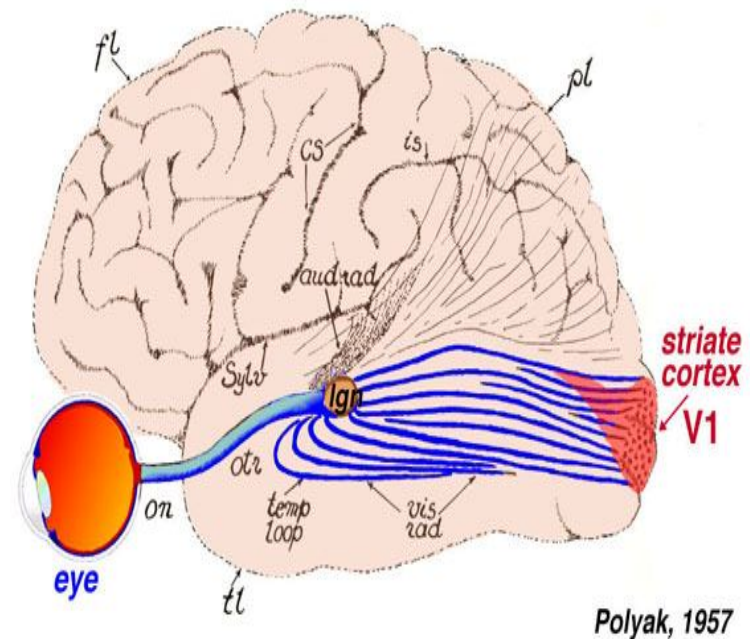


Figure 8. Visual input to the brain goes from eye to LGN and then to primary visual cortex, or area V1, which is located in the posterior of the occipital lobe. Adapted from Polyak (1957).



According to the International Classification of Diseases(ICD)-10, there are 4 levels of visual function:

- ✓ Normal vision
- ✓ Moderate visual impairment
- ✓ Severe visual impairment
- ✓ Blindness;

based on measurement of visual acuity(form vision) and/or field of vision

# Normal Vision

**Distance Vision**

Near Vision

Color Vision

**Field of Vision**

Contrast Sense

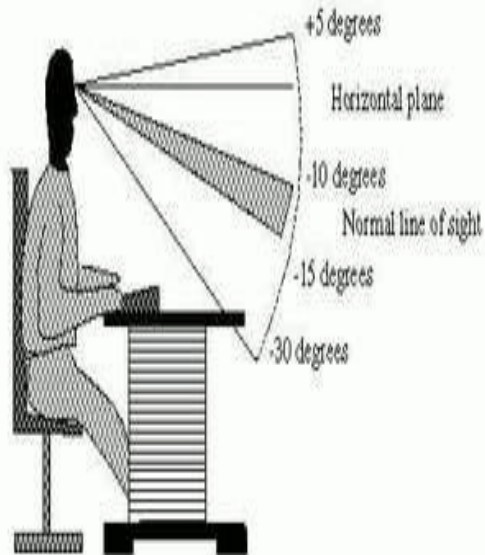
Normal Vision is  
Essential. About 85% of  
our perception, learning,  
cognition and activities  
are mediated through  
Vision.



The Snellen Visual  
Acuity(VA) Test chart

←  
**Normal Distance VA.**

# Field of Vision

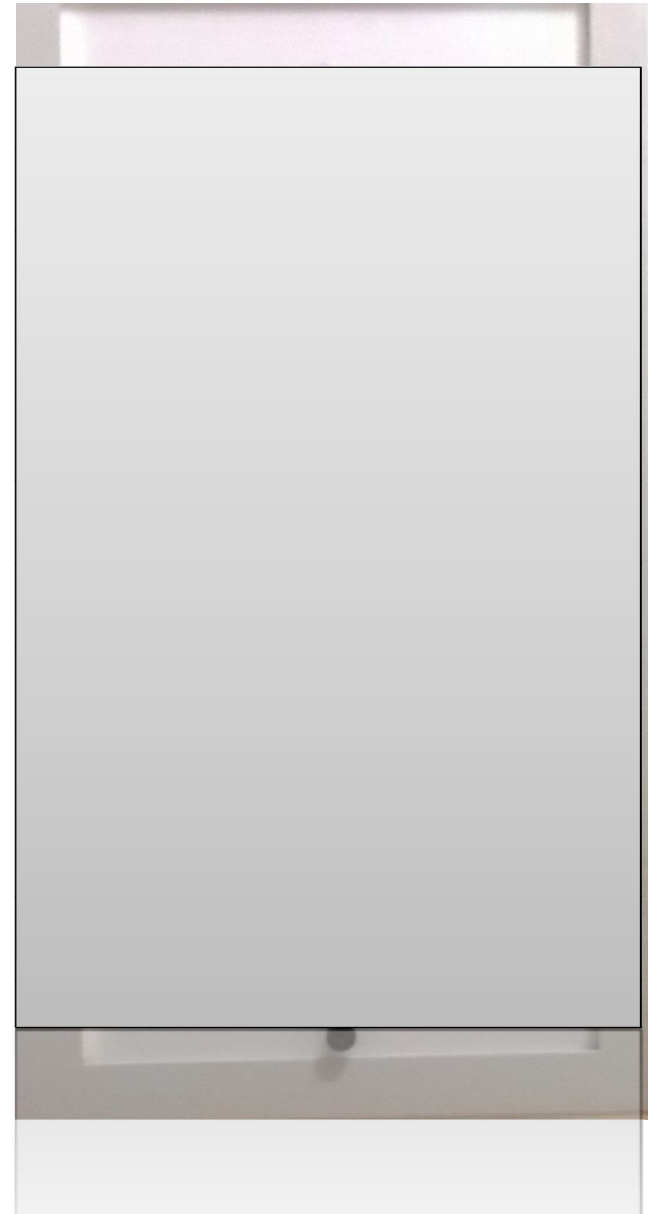


Visual Field Test with The Goldman Perimeter

## **Visual Impairment/Vision loss**

- **Moderate:** Presenting/Entry VA of  $< 6/18$  to  $6/60$  , or a corresponding VF loss to  $< 20$  degrees in the better eye;
- **Severe:** Presenting VA of  $< 6/60$  to  $3/60$ , or a corresponding VF loss to  $< 10$  degrees in the better eye
- **Blindness:** Presenting VA  $< 3/60$  – no PL
- (WHO, 2007)

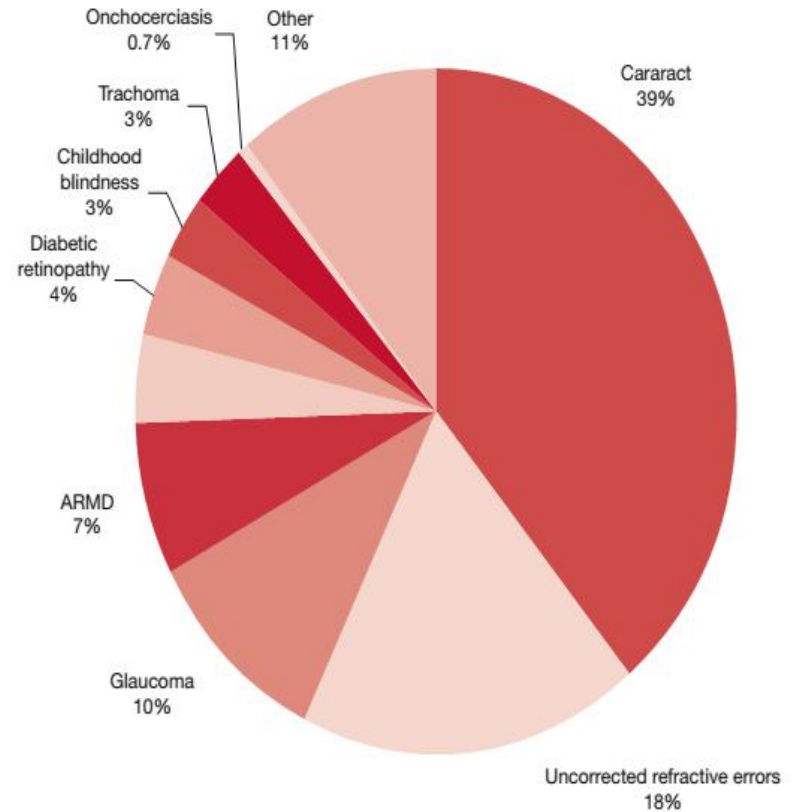
# Moderate & Severe Visual Impairment(VI)



# VI & Blindness- Global Causes

Cataract  
Refractive Errors  
Glaucoma  
ARMD  
DR  
Childhood blindness  
Trachoma  
River blindness  
Others

**Figure 3.** Global causes of blindness due to eye diseases and uncorrected refractive errors



WHO(2007)

Data released by WHO in 2012 indicate that

- ✓ 285 million people are estimated to be visually impaired worldwide. Out of this No.
- ✓ 39 million are blind;
- ✓ 246 million have moderate-severe VI

The major causes of Visual Impairment was listed to include

- ✓ Uncorrected Refractive Error,
- ✓ Un-operated Cataract, and
- ✓ Glaucoma ()



## What is the Problem with Glaucoma?

- **Glaucoma** is the most common cause of irreversible blindness worldwide (WHO, 2007; Budenz, et al, 2013), affecting about 60.5 million people as at 2010.
- This number is estimated to reach 80 million by 2020 (Murthy & Johnson, 2012)

Glaucoma(POAG) is highly prevalent among adults in SSA (3-7%), with early onset, and progresses more rapidly (Buden et al, 2013; Olawoye & Tarella, 2014;Tham et al, 2014).

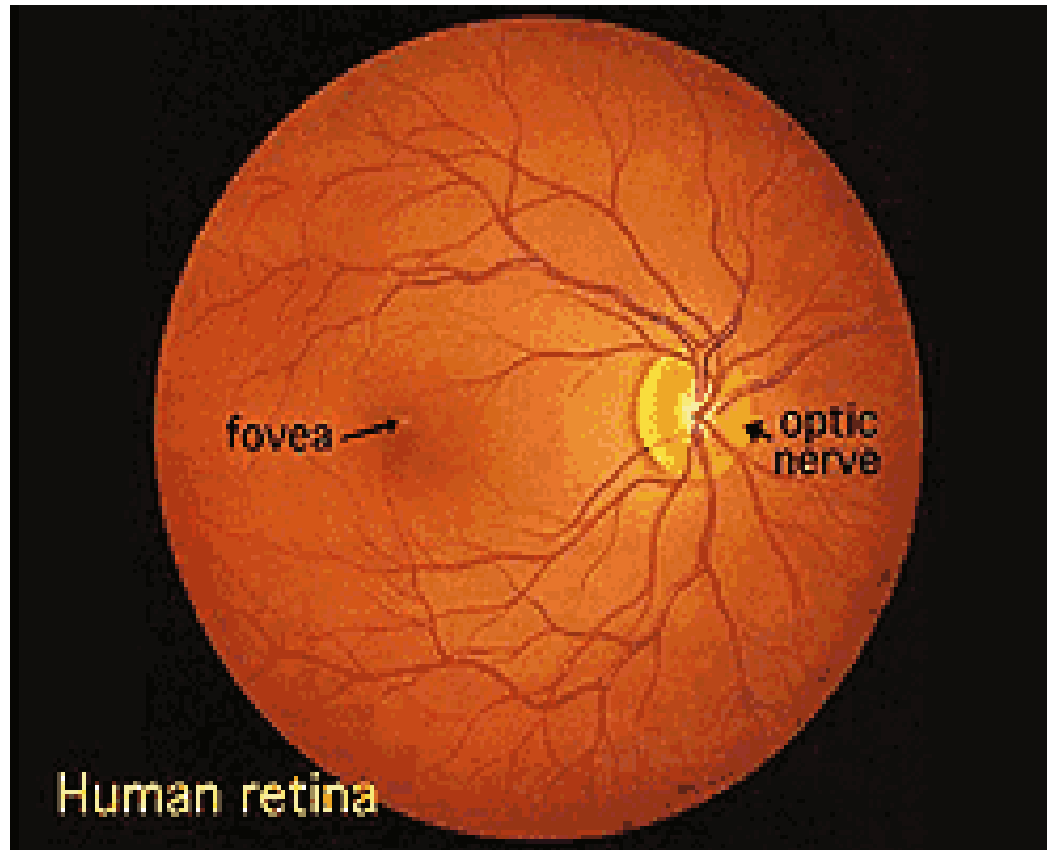
These factors are compounded by poor awareness and low knowledge about glaucoma even by persons affected (Kyari et al, 2013)

# ❑ **What We Need to do to Reverse the Global Burden of Visual Impairment**

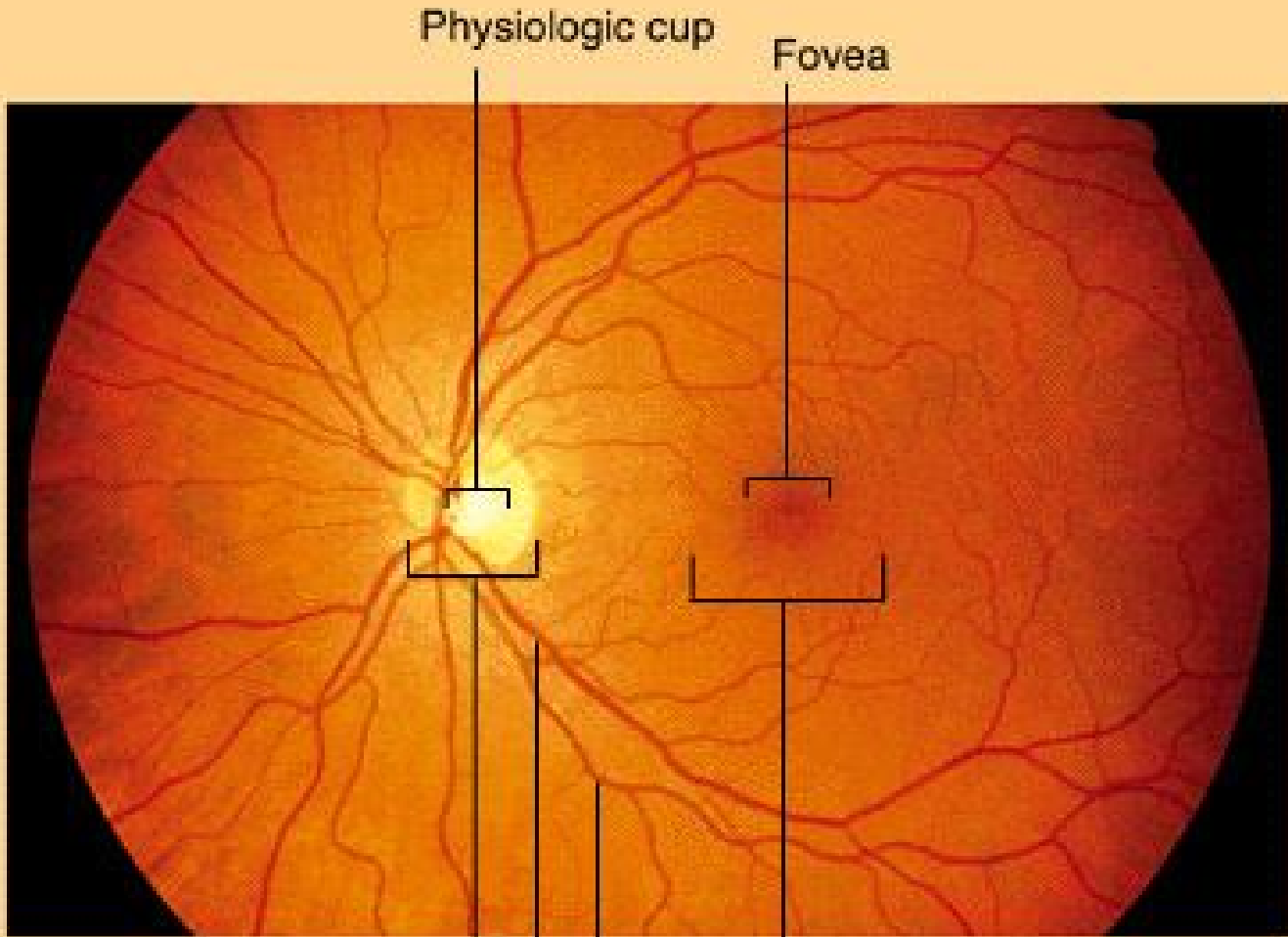
- ✓ Provision of eye care services,
- ✓ Professional commitment to prevention of VI
- ✓ Public awareness about solutions to VI/Public health action and Utilization of eye health care services
- ✓ Commitment/Support of NGOs and Corporate bodies.

# WHAT IS GLAUCOMA.

- **Glaucoma** - a group of eye diseases characterized by **optic nerve damage**(optic neuropathy) and **visual field loss** which progress to irreversible loss of vision or blindness in the absence of early detection and treatment.
- It's main risk factor is **increased intra-ocular pressure(IOP)**.



The Human Retina as seen with the Ophthalmoscope



Physiologic cup

Fovea

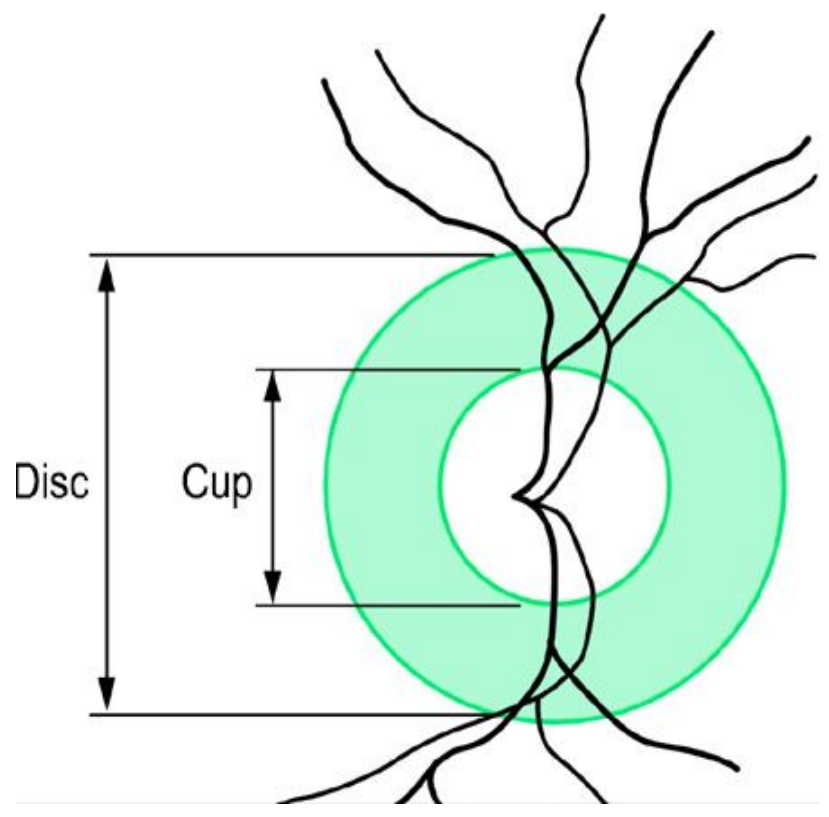
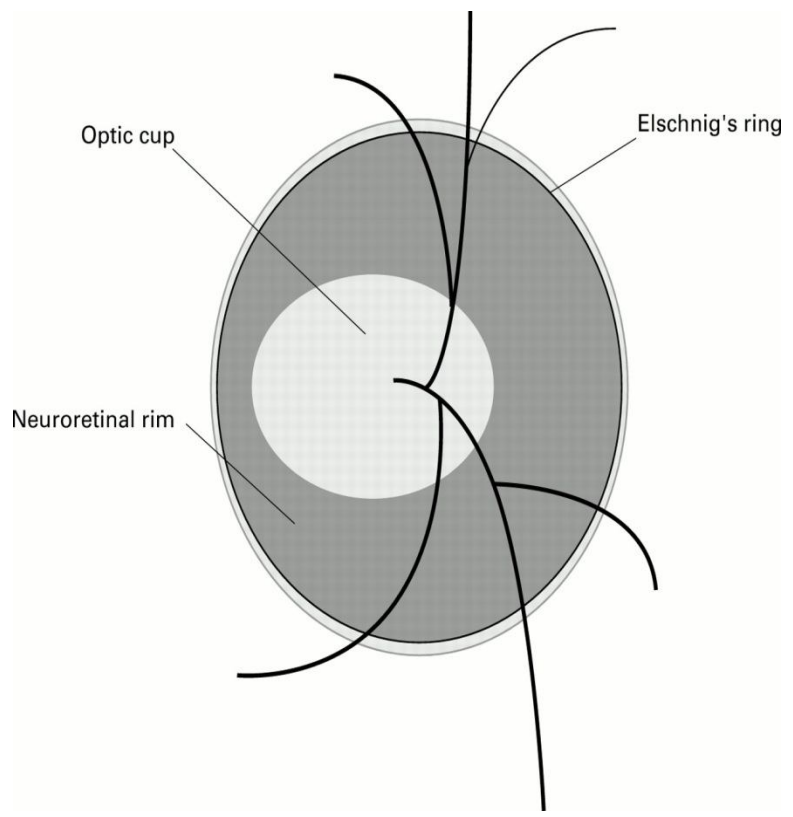
Macula

Retinal artery

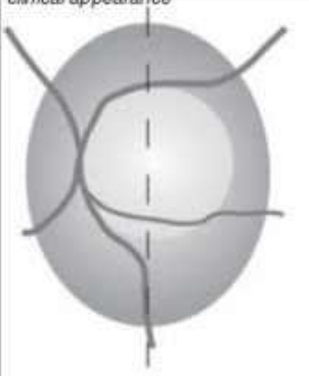
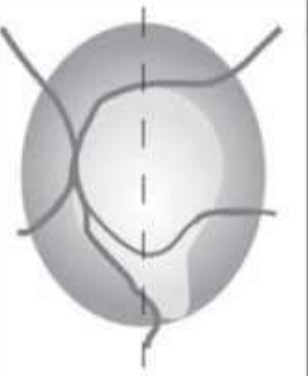
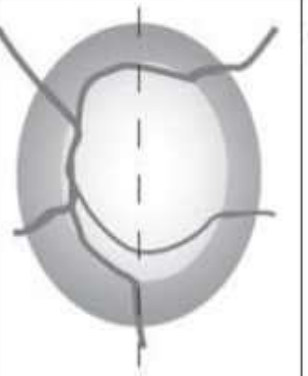
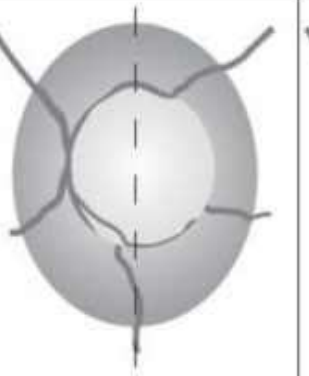
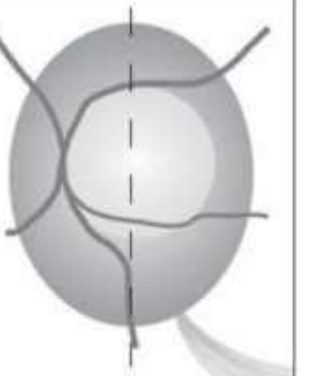





Retinal vein

Neuroretinal rim



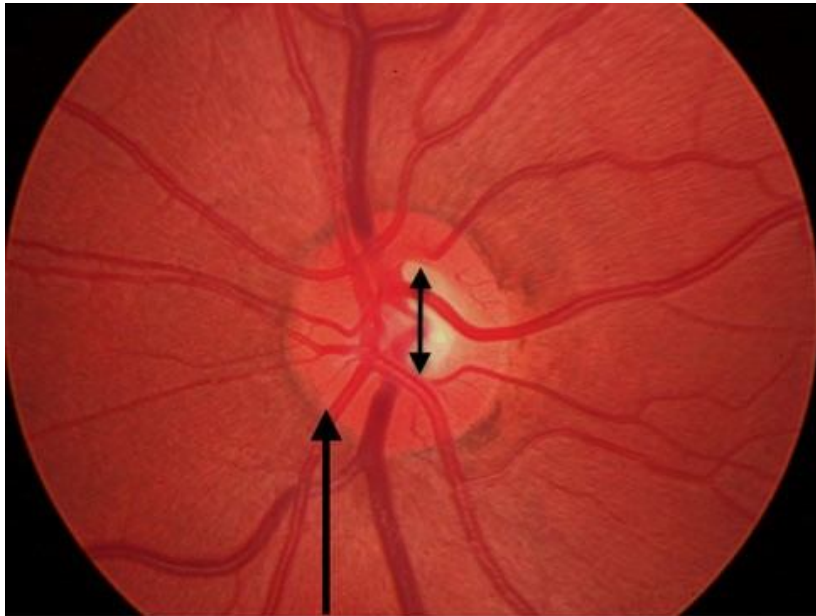


# Schema of optic disc shapes in glaucoma

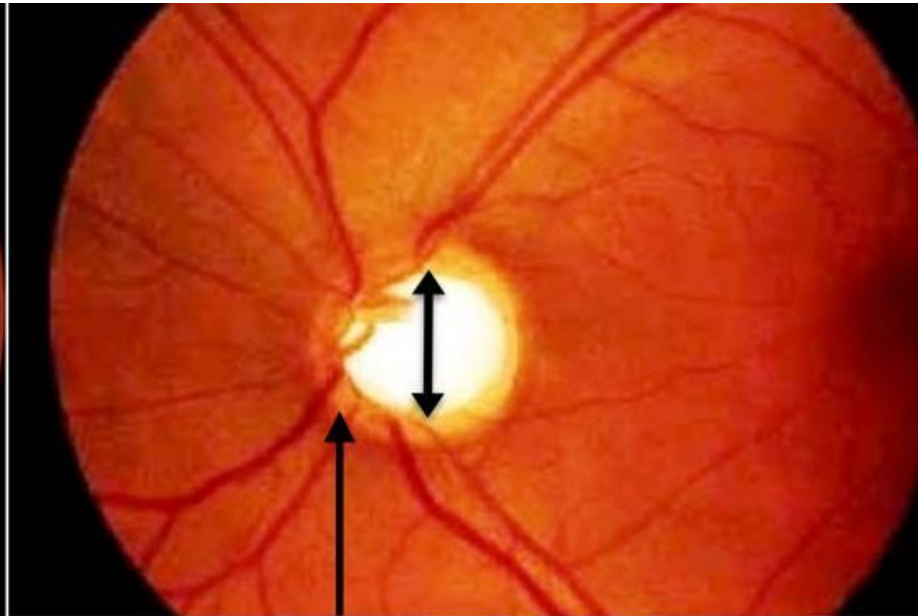
normal optic disc	focal rim thinning "notching"	regional or diffuse rim thinning	excavation	nerve fiber layer defect
<i>clinical appearance</i> 				
<i>cross sectional view</i> 				
Number (%) of progressive changes	15/92 (16%)	50/92 (54%)	82/92 (89%)	2/92 (2%)



# The Retina in Normal & glaucomatous eyes



Normal optic nerve head



Glaucomatous cupping



What Vision is like in Glaucoma

**NORMAL VISION**



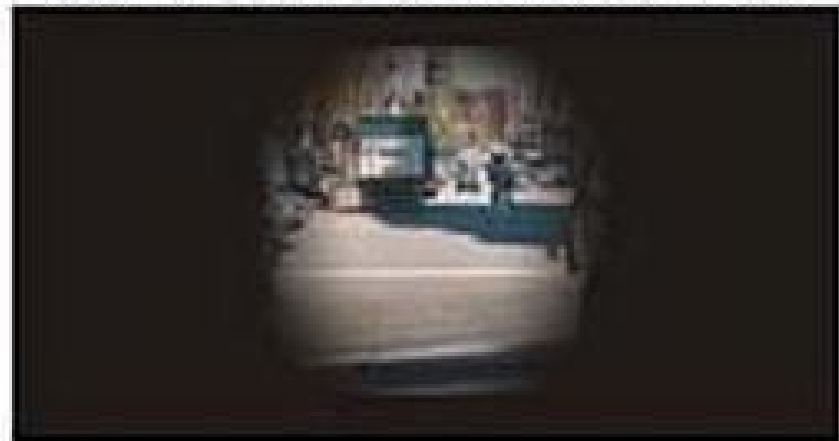
**EARLY GLAUCOMA**



**ADVANCED GLAUCOMA**



**EXTREME GLAUCOMA**



**VISION IN GLAUCOMA**

# What Vision is like in Glaucoma

Normal Vision



Early Glaucoma



Advanced Glaucoma



Extreme Glaucoma



(Photo by CHONA M. DUROGA)

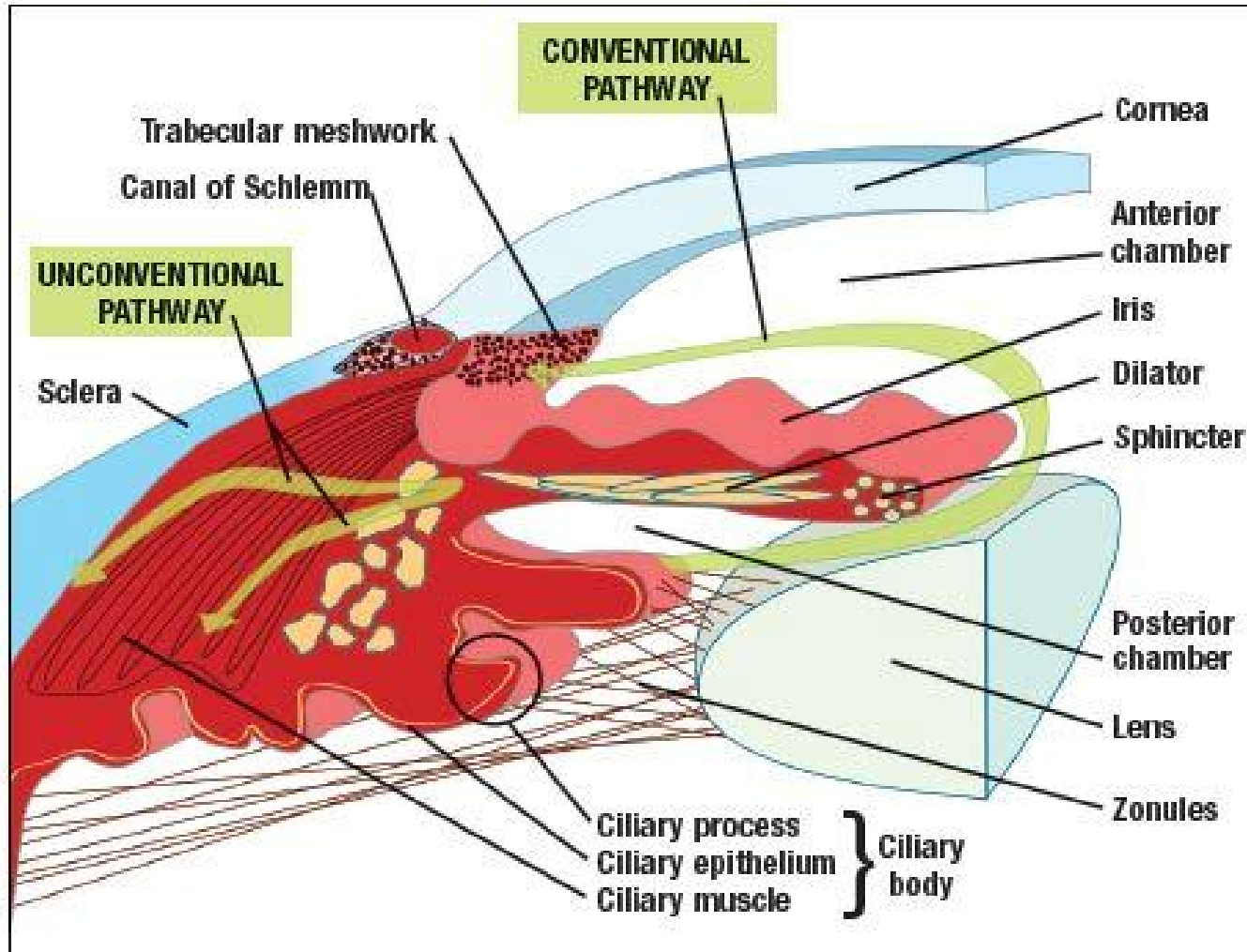
# What Causes Glaucoma?

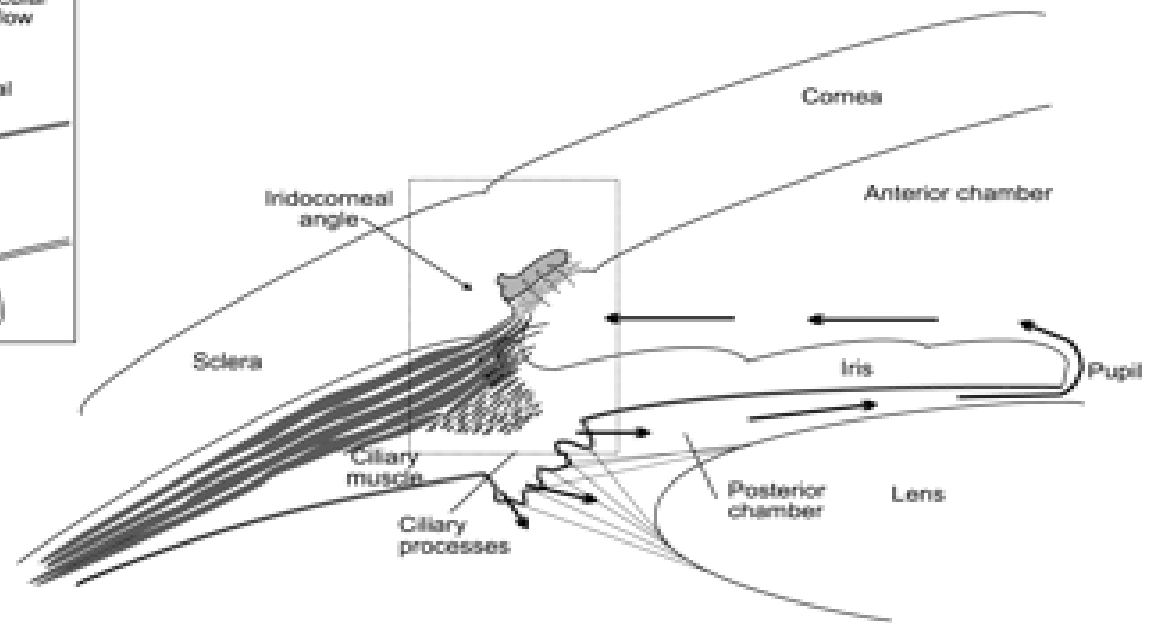
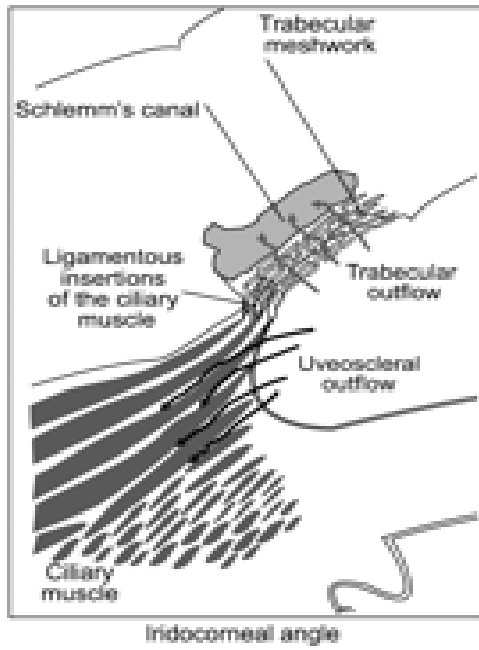
The cause is unknown in Primary gl, but the following factors contribute.

- ✓ Elevated Intraocular Pressure(IOP)
- ✓ Decreased Optic Nerve Perfusion
- ✓ Alteration in optic nerve microcirculation
- ✓ Glutamate toxicity & Oxidative damage.

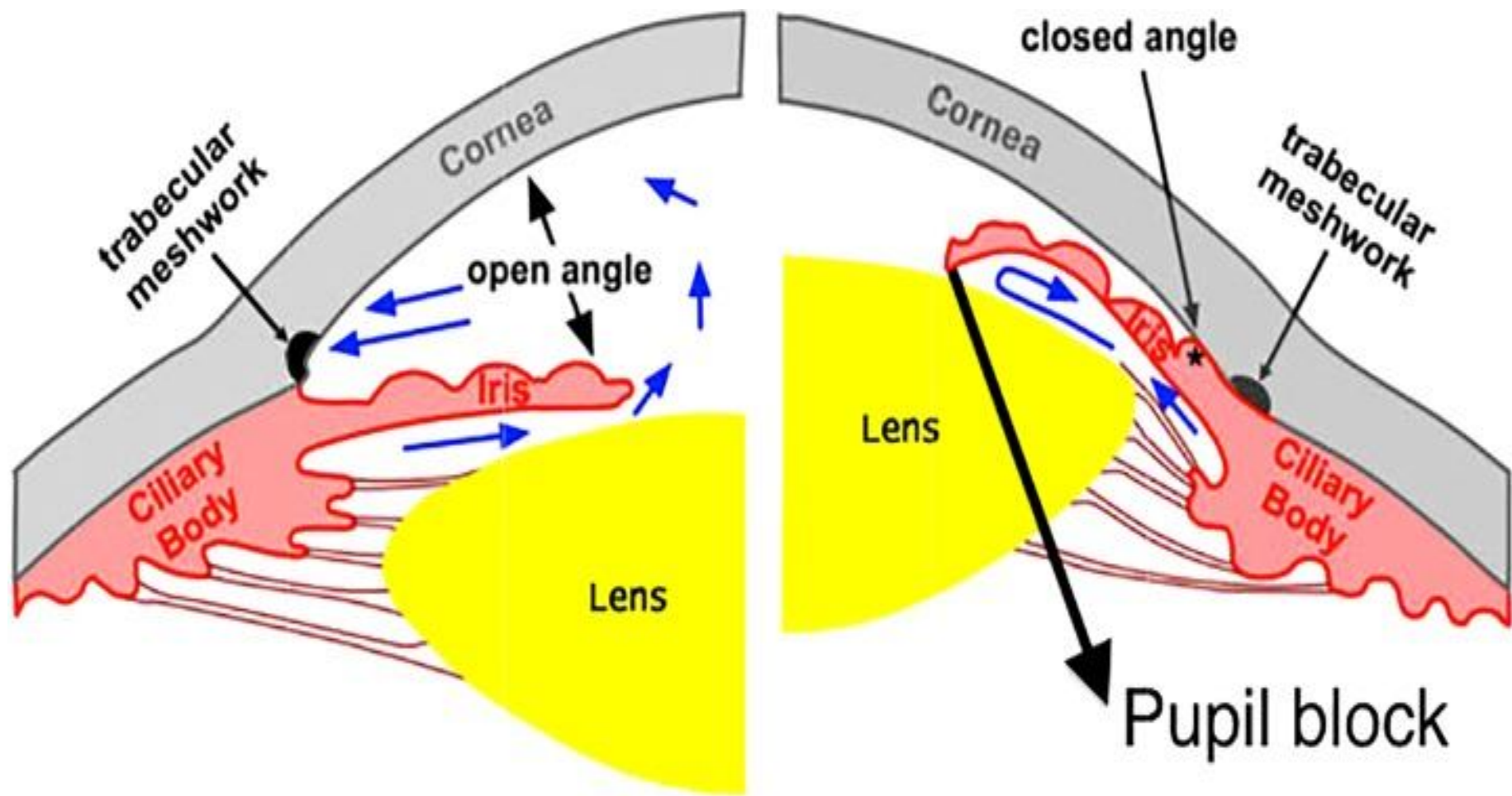
- **Intraocular Pressure:** the pressure exerted on the coats of the eye by its internal fluid contents, depends on the dynamic balance between rate of aqueous humor flow in and out of the anterior chamber.
- **Normal= 15 +/- 3 mmHg**
- **Glaucoma: IOP >22, up to 60 mmHg.**

# Anatomy: Aqueous Humor Production & Drainage









## Different Types of Glaucoma

- ✓ Primary Open Angle glaucoma(POAG)
- ✓ Primary Angle Closure glaucoma(PACG)
- ✓ Normal Tension glaucoma(NTG)
- ✓ Ocular hypertension
- ✓ Secondary glaucoma
- ✓ Congenital/infantile/childhood
- ✓ Subtypes: drug-induced, traumatic, uveitic, lens- induced, angle closure suspect, acute/chronic glaucoma, etc.,



**Figure 3** Acute angle closure glaucoma secondary to choroidal hemorrhage.

**Note:** © Springer and *Ophthalmologe*. 2005;102(11):1090–1096, Akutes Winkelblock-



## Epidemiology: Who is at Risk?

### PACG

- Family hx of gl
- Mongoloid origin
- Female gender
- Smaller eyes
- Hypermetropia
- Older age

### Risk factors for POAG

- Elevated IOP
- Age 45 +5
- African ancestry
- Family Hx of glaucoma
- Myopia, thin cornea

What are the warning signs?

## Early Detection

- ✓ **Screening:** a process of identifying apparently healthy people in a defined population who may be at increased risk of a disease or condition, & who can benefit by further investigation, information or TX (Wormald & Lindfield, 2012).

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**FUTO OPTOMETRY CLINICIANS READY FOR  
SCREENING**





VISUAL ACUITY ASSESSMENT DURING  
SCREENING



**OPHTHALMOSCOPY DURING SCREENING**

## CASE REPORT

A 9 yr. old female  
with advanced  
glaucomatous  
optic neuropathy  
& severe VI



TAKING CASE HISTORY DURING  
SCREENING

# Screening Tests

- Tonometry: measure IOP
- Ophthalmoscopy: Assess vertical cup/disk ratio
- Contrast sensitivity test: measure vision under varying contrast
- Oblique flashlight test: estimate anterior chamber



Tip A





Ocular Response Analyzer



OCULUS EASYFIELD Visual field Analyzer

## Management of glaucoma

- Depends on the nature and severity.
- In each case generally,
- Glaucoma Can Not Be Cured, But Can Be Controlled



# Glaucoma medications

- Topical Eye Drops, e.g., **prostaglandin analogs** reduce elevated IOP by facilitating aq humor outflow.



## Glaucoma medications2

- Topical eye drops, e.g., **beta blockers** reduce IOP by suppressing aq humor secretion

Betaxolol  
Timolol  
Levobunolol



## Glaucoma medications3

- Topical Eye drops, e.g., Alpha Agonists reduce IOP by suppressing Aq humor production

Brimonidine



A new beta blocker-free, fixed-combination therapy (Simbrinza) for glaucoma patients combines brinzolamide 1% and brimonidine tartrate 0.2% into one multidose bottle.

*(Photo courtesy of Alcon Laboratories)*

# Glaucoma medications4

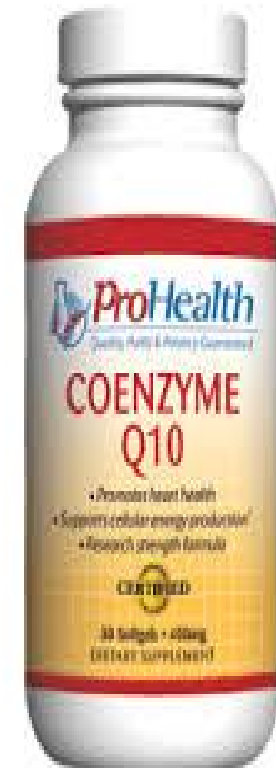
Carbonic anhydrase  
inhibitors  
e.g., brinzolamide  
(aqueous  
surppressants)



# Neuro-protection in Glaucoma

- Calcium channel blockers
- Memantine
- Melatonin analogs
- CO-ENZYME Q<sub>10</sub>
- Anti-oxidants
- Alpha-Lipoic Acid.





**SOME NATURAL SUPPLEMENTS  
CAN BE HELPFUL IN GLAUCOMA**

# LASER & SURGICAL PROCEDURES

- E.g., Argon Laser Trabeculoplasty
- Surgical trabeculectomy
- Etc.,

# Conclusion/ recommendations

- Glaucoma is an eye disease with a devastating impact on the most important of our health related sensory abilities- vision or eyesight.
- Early detection is the key. Several simple, safe and reliable screening tests such as ophthalmoscopy, tonometry, and contrast sensitivity tests are available in optometric and ophthalmologic units for its early detection.
- Medications, surgical intervention, keeping to doctor's appointments, and being well informed about the disease, all have proved to be effective and helpful in controlling the progressive damage due to glaucoma.



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# RECOMMENDATIONS

Be part of  
something  
beautiful



THANK YOU

# EPILOGUE







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