



DIAGNOSTIC & THERAPEUTIC APPROACHES IN OPHTHALMOLOGY

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Chapter 1

Skills 1-8

- Pathophysiology of vision
- Motility - Strabismus
- Binocular vision

TS 1 : Discrimination ability

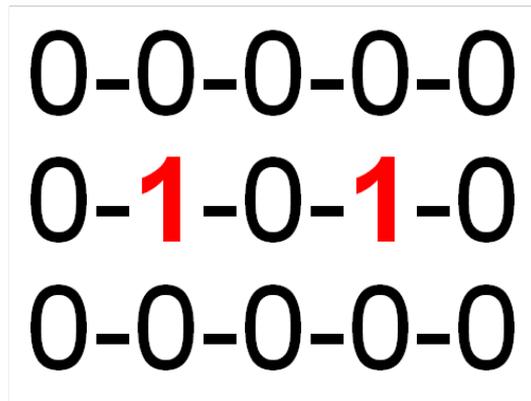
By convention:

Differentiation of 2 stars in the night sky

- 1 arc minute = Visual Acuity: 10/10
- 2 arc minutes = Visual Acuity: 5/10
- 10 arc minutes = Visual Acuity: 1/10
- 20 arc minutes = Visual Acuity: 1/20

Model of cone stimul.

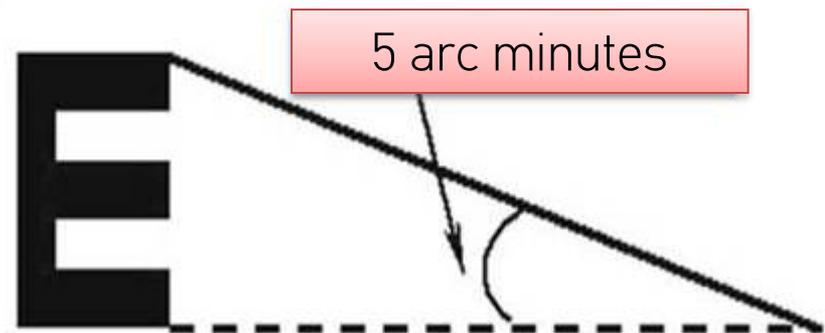
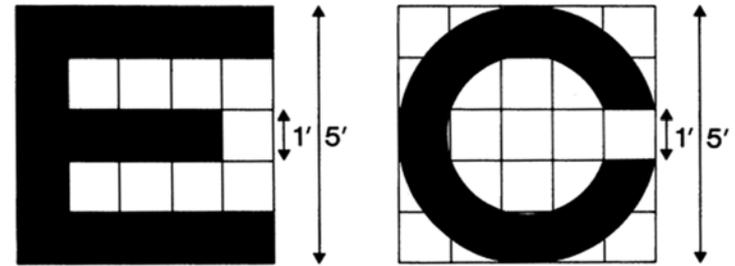
(15 cones)



0-0-0-0-0
0-1-0-1-0
0-0-0-0-0

TS 1 : Visual acuity measurement

- **Angular measurements**
l / L : size / distance
- **Magnification/Reduction**
- **Dependent on:**
 - Clear Media
 - Refraction
 - Density of cones
- **Tested** with specially designed charts



TS 1 : Assessment of Visual Acuity

- **1.0** → Clear distance vision, able to thread a needle
- **0.7** → drives safely
- **0.5** → takes walks outdoors safely, recognizes faces, cooks, shaves, inserts keys, reads subtitles,
self-sufficient
- **0.2** → walks about in neighbourhood, cannot read
- **0.1** → walks about indoors
- **0.05** → moves into his/her own property only

TS 1 : Optical Ability

- The most important parameter in estimating sight

*** VF **must be intact** !

- **Logarithmic relationship** (Weber-Fechner Law)

Visual Acuity – Optical Ability

VA: **10/10** - OA: **100%**

VA: **5/10** - OA: **69%**

VA: **3,2/10** - OA: **50%**

VA: **1/10** - OA: **10%**

VA: **1/20** - OA: **7%**

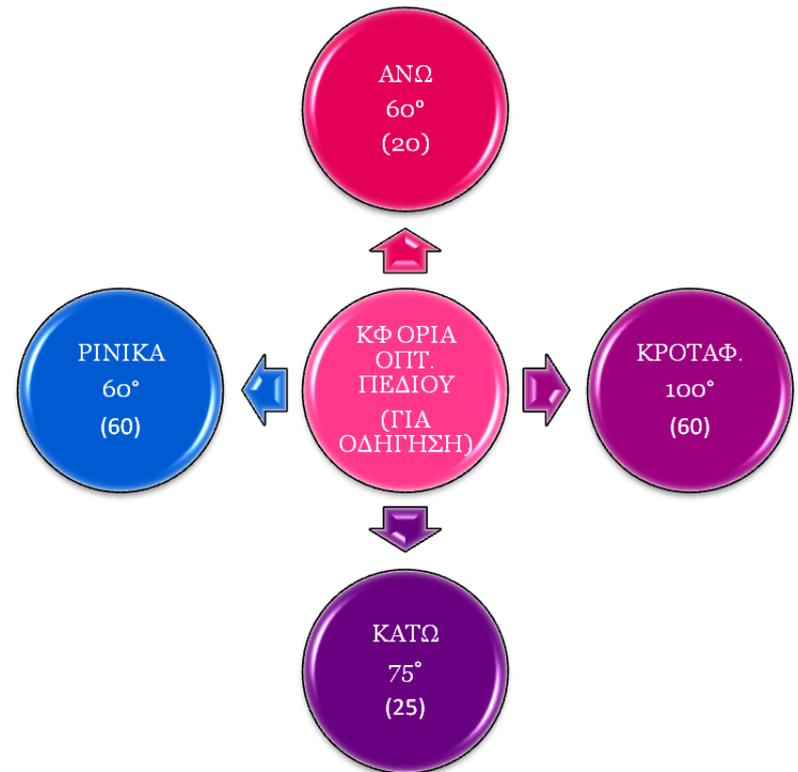
VA: **1/100** - OA: **0%**

TS 1 : Normal Visual Field Extend

Visual acuity is **NOT** the only component of vision

Visual Field

The space or range within which objects are visible to the immobile eyes at a given time



TS 1 : Visual field defects - Scotomas

POSITIVE

Obstruction in perception of VF

Damage before photoreceptors
i.e.
haemorrhage

NEGATIVE

Impaired interpretation of perception

Damage within or centrally to ganglion cells
i.e. Glaucoma

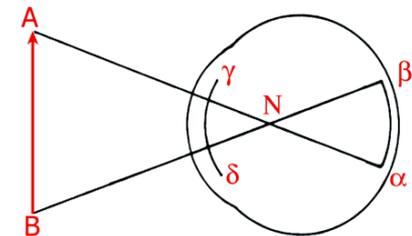
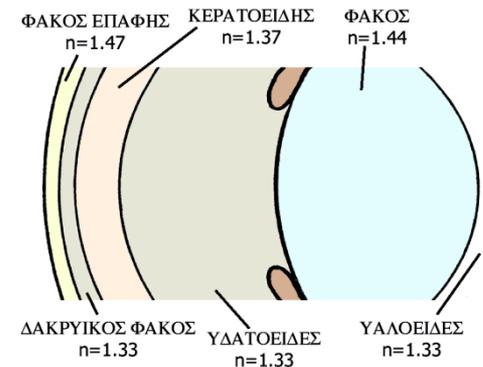
TS 1 : Hemianopsia

- What is it?
 - Decrease or total blindness in half the visual field
- Horizontal → Ophthalmologist
 - It is due to retinal dysfunction
- Vertical → Neurologist
 - Lesions within or beyond the optic chiasma



TS 2 : Refraction

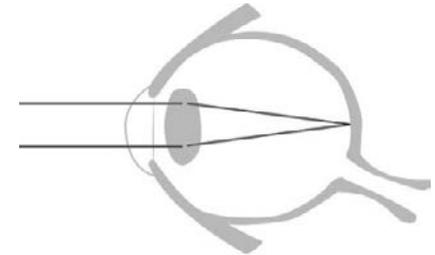
- **Refraction** = **Bending** of light as it passes from one transparent medium to another of different density
- In the eye **refraction** is a result of :
 - Cornea and crystalline lens curvatures
 - Differentiation of their refractive indexes compared to air.
- Retinal image is formed by convergent rays passing **through the optical centre** of the eye (N)



TS 2 : Refractive Errors

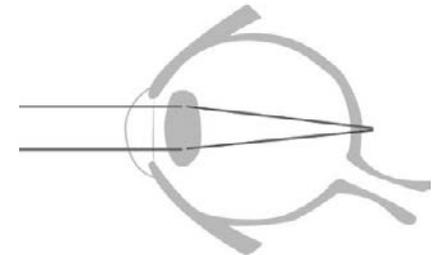
- Axial

- (antero-posterior diameter of eye)



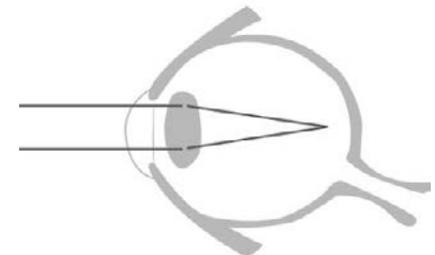
- Refractive

- (curvature changes)



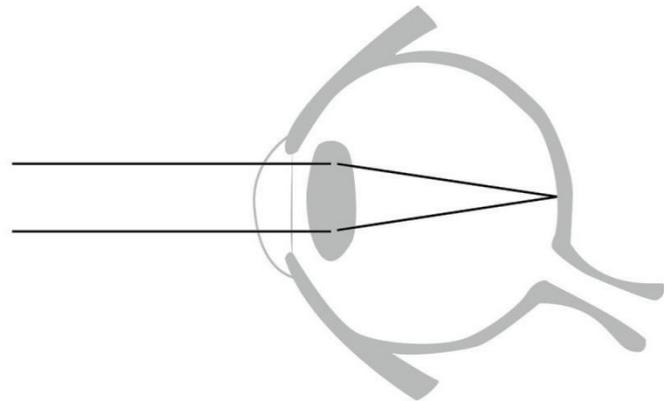
- Compound

- Spherical (Myopia-Hyperopia)
- Cylindrical (Astigmatism)



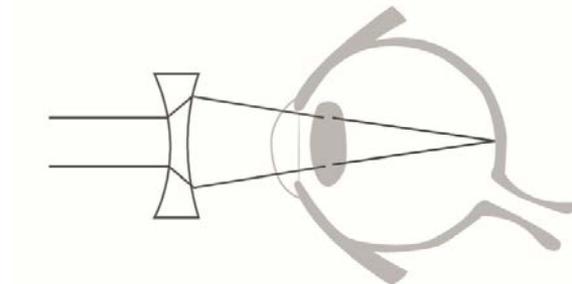
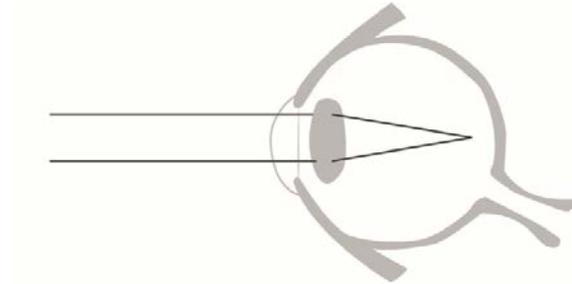
TS 2 : Emmetropia

- Image from distance is formed clearly on retina in a state of rest position



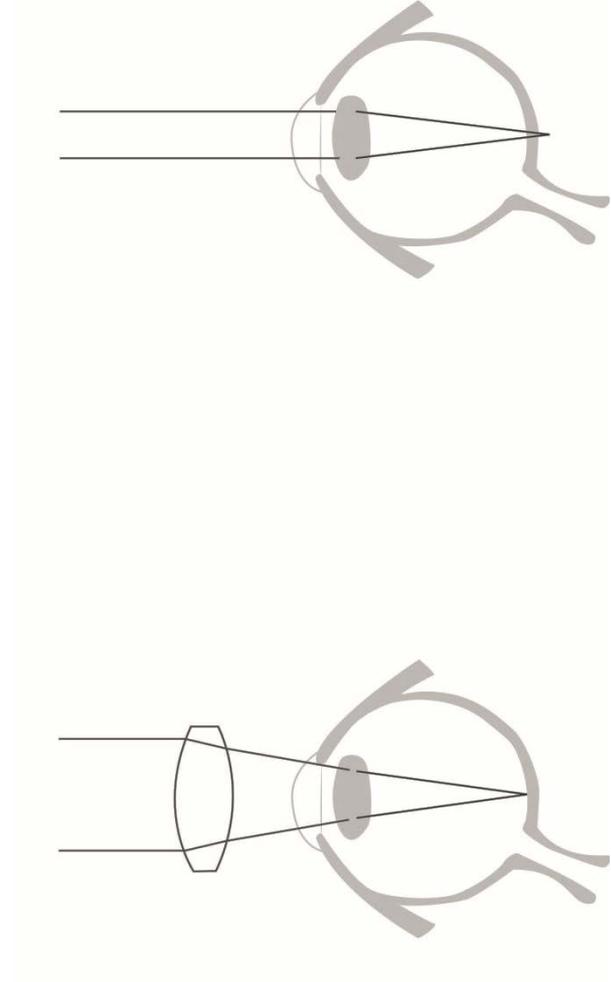
TS 2 : Myopia

- Distant object is focused **before** the retina
 - Due to longer axial length **or/and** steeper curvature of cornea
- **Opposite** to Hyperopia
- Correction with **biconcave** (divergent) lenses

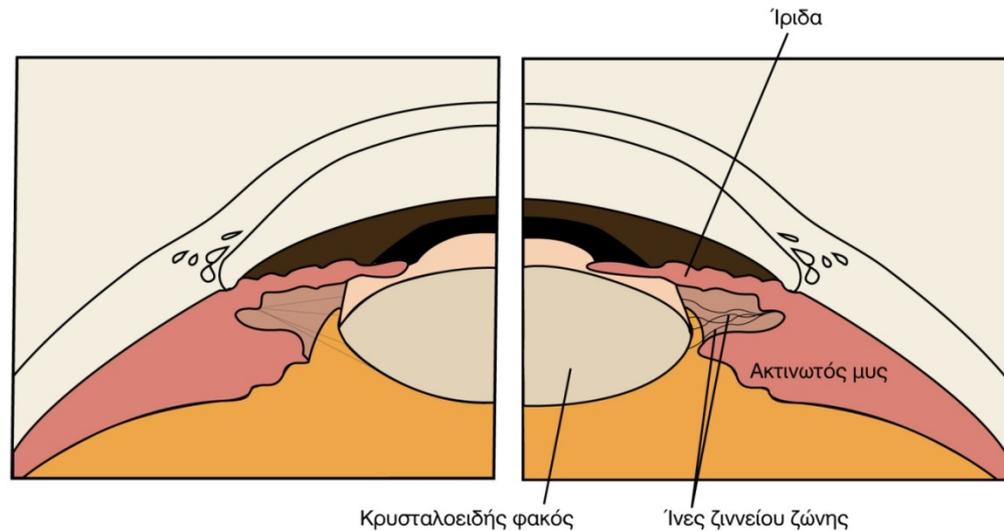
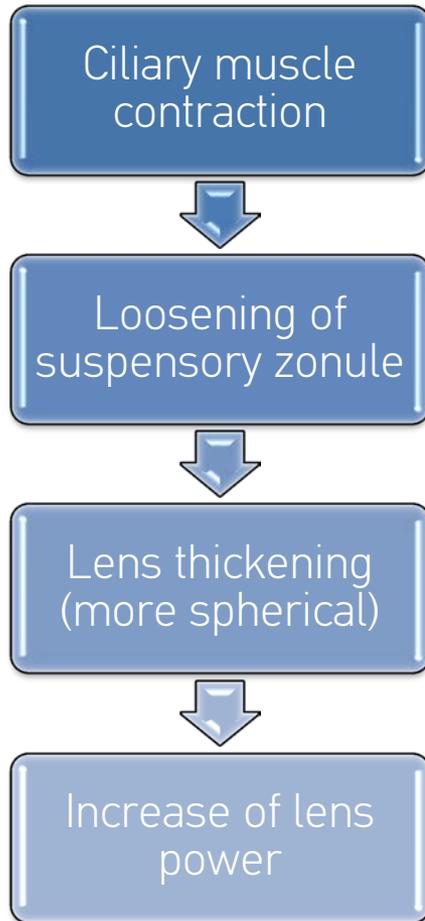


TS 2 : Hyperopia

- Distant object is focused **beyond** the retina
 - Due to shorter axial length or/and flatter Curvature
- **Opposite** to Myopia
- Correction with **biconvex** lenses (convergent)



TS 3 : Accommodation



TS 3 : Accommodation

- Emmetropes accommodate for Near
- Hyperopes accommodate for Near and Distance
State of constant contraction of ciliary muscle

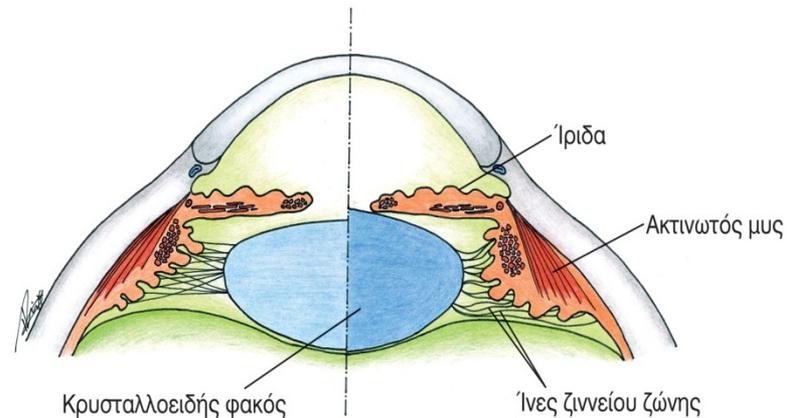


- **Eye-strain** : Redness, fatigue, headaches at the end of the day
- **Asthenopia**: Temporary de-focus of image
- **Atropine and Tropicamide** cause temporary loss of accommodation

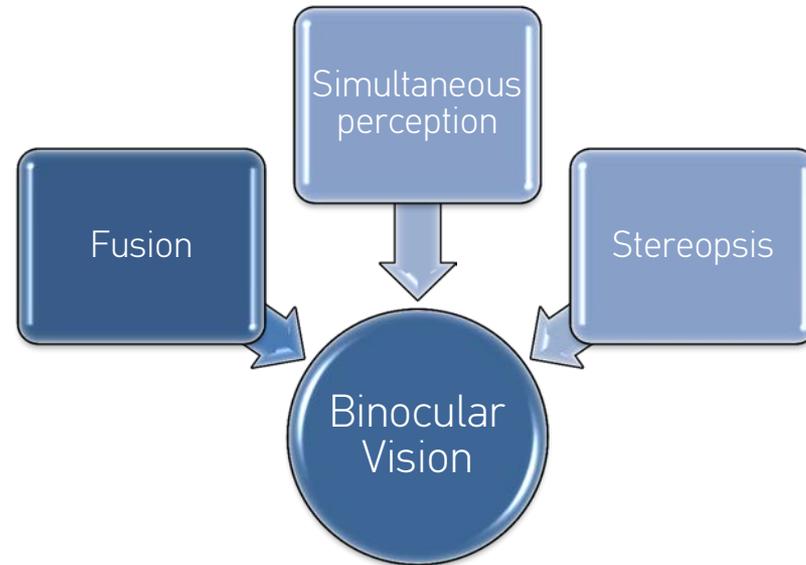
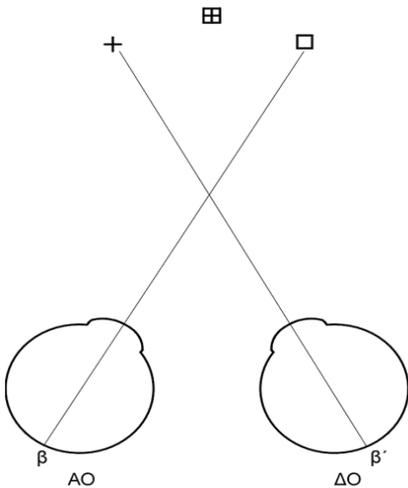
TS 4 : Presbyopia

- Weakening of accommodation **due to crystalline lens changes** (harder and less easily moulded)
- **CAUTION:** not the opposite to myopia

- It manifests :
 - At 45 in emetropes
 - Earlier in hyperopes
 - Later in myopes



TS 5 : Binocular Vision



- **Prerequisites:**

- normal and relatively equal visual acuity in both eyes
- optic axes parallel when eyes focus at distance
- equal refraction between two eyes

TS 5 : Retinal correspondence - Diplopia

- Inherent relationship between paired retinal visual cells between the two eyes. Images from one object stimulate both cells, which transmit the information to the brain, permitting a single visual impression localized in the same direction in space
- Disruption results in **DIPLOPIA**



TS 6 : Strabismus

- Pseudo-strabismus (epicanthus)
 - Short inner canthal ligament

Cornel reflexes are centred



- Accommodative convergent strabismus
 - Due to excess accommodative convergence in hyperopic kids

It may be treated with correction of hyperopia



TS 7 : Strabismus

■ Concomitant strabismus

- Angle formed by optic axes relatively stable in all positions of gaze
- Convergent (inwards)
- Divergent (outwards)



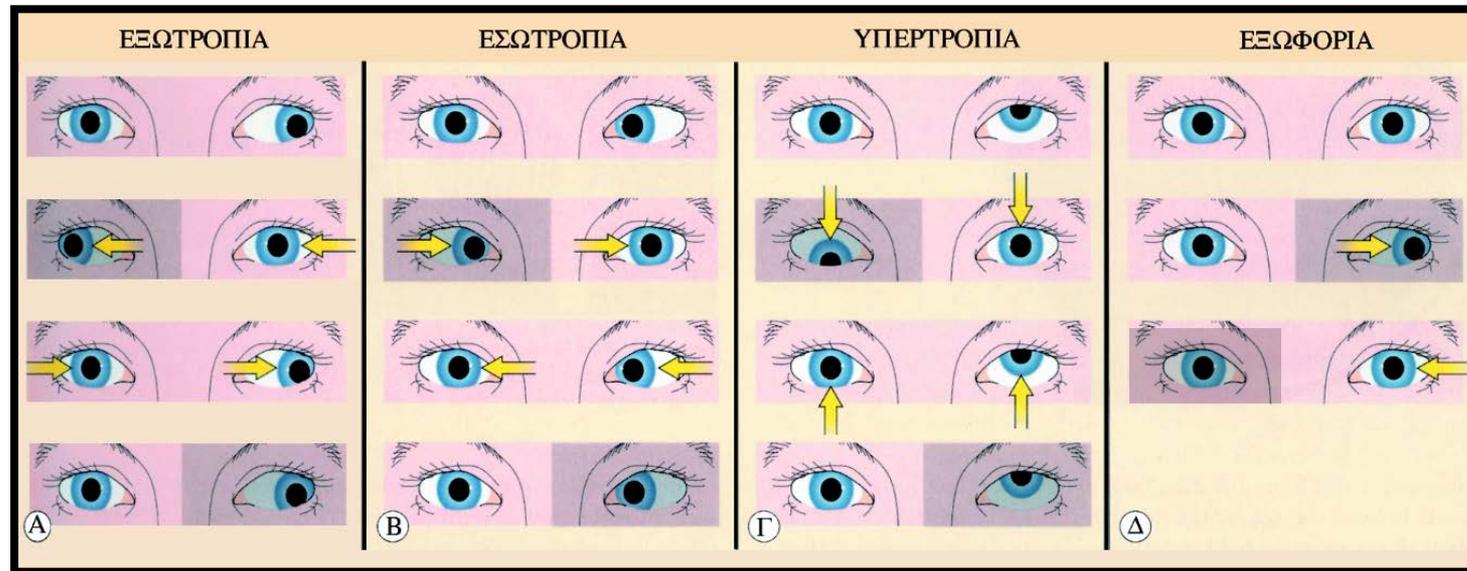
■ Incomitant strabismus (paralytic or restrictive)

- Angle of strabismus changes largely between different positions of gaze
- Diplopia



TS 7 : Strabismus

- Manifest-tropia
 - Cover-uncover test



- Latent-phoria
 - Swinging (alternate) cover test

TS 8 : Amblyopia

- Normal development of vision occurs early in life through on-going, uninterrupted stimulation of vision-receptive cells in the brain
- When the above requirements are not met, **AMBLYOPIA** develops in the weak eye
- **CAUSES** → Strabismus, Anisometropia, Deprivation
- It **MUST BE TREATED WITHIN THE FIRST DECADE OF LIFE** by patching of the dominant eye
- Otherwise, condition becomes **permanent!**



Electronic Referrals - 1st Chapter

1. <http://www.nlm.nih.gov/medlineplus/ency/article/003396.htm>
2. <http://webvision.med.utah.edu/book/part-viii-gabac-receptors/visual-acuity/>
3. http://www.cis.rit.edu/people/faculty/montag/vandplite/pages/chap_9/ch9p1.html
4. <http://www.eyeland-design.com/CD-MSD-EN/VS-MSD-EN.swf>
5. <http://www.inclusivedesigntoolkit.com/betterdesign2/simsoftware/simsoftware.html>
6. <http://emedicine.medscape.com/article/1219573-overview>
7. <http://emedicine.medscape.com/article/1214490-overview>
8. <http://cim.ucdavis.edu/eyes/version1/eyesim.htm>
9. <http://eyeontechs.com/new/?p=230>
10. <http://emedicine.medscape.com/article/1214603-overview>