UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
„NICOLAE TESTEMIȚANU” DIN REPUBLICA MOLDOVA

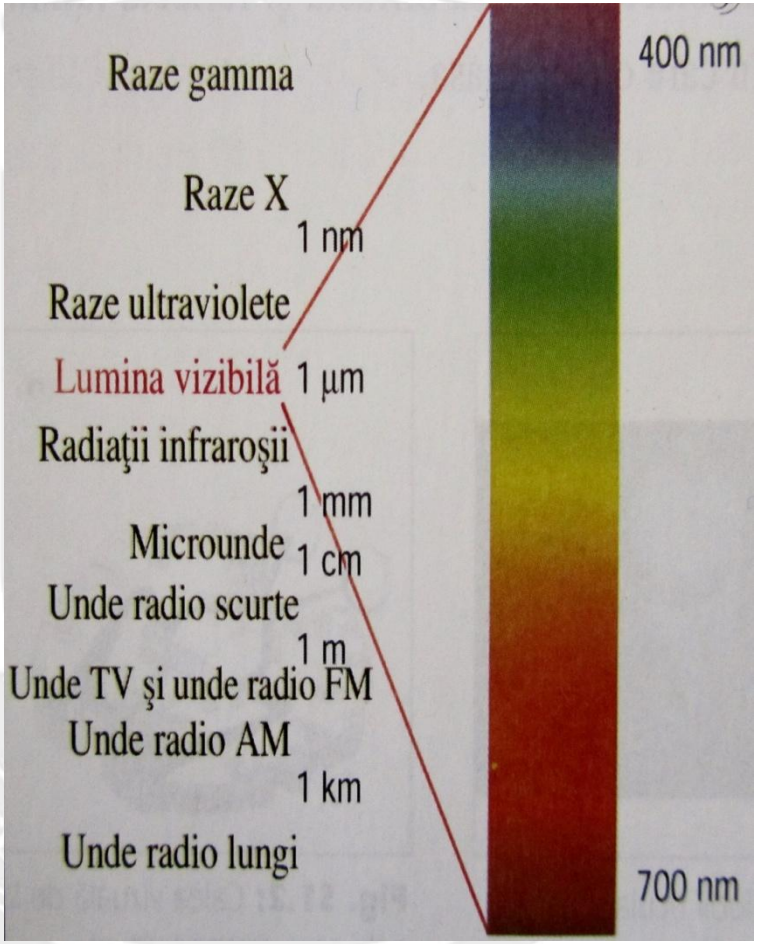
Catedra Oftalmologie

THE VISUAL FUNCTIONS

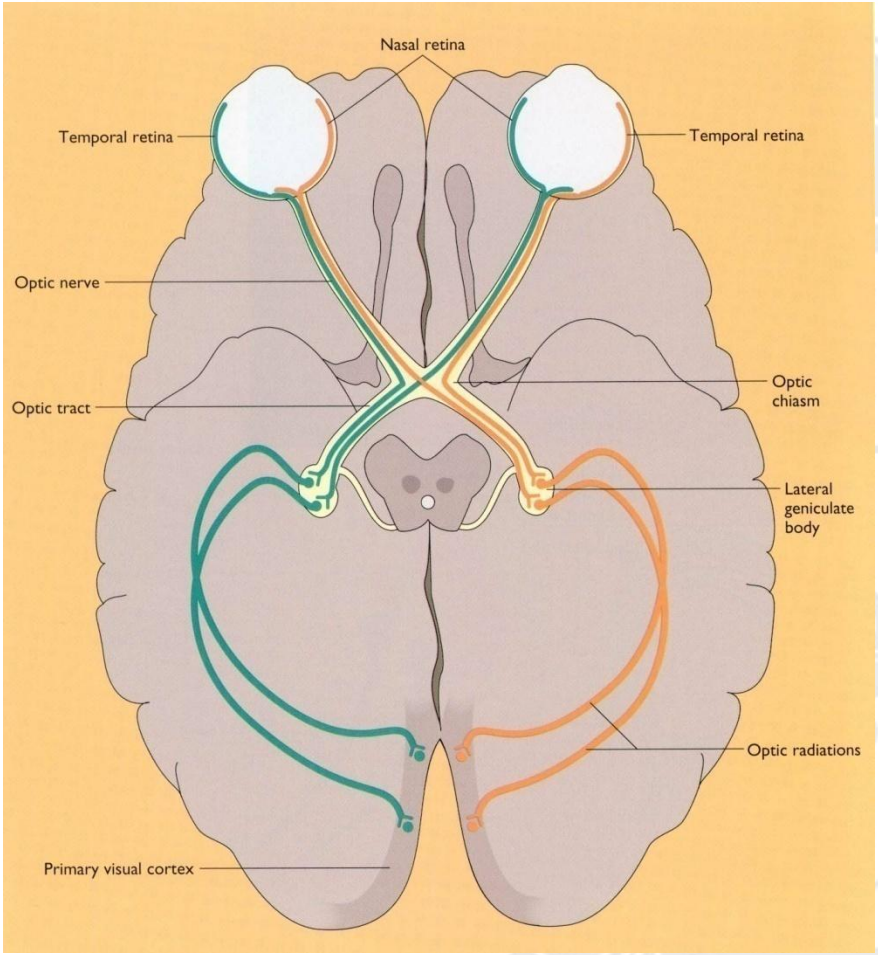
Assistant Professor
CRISTINA ȘCERBATIUC

The visual analyzer

- Excitant factor– light (spectrum 375 – 760 nm)
- 3 segments:
  - peripheral– light reception (retinal photoreceptors– cones and rods)
  - Transmission– optical pathway
  - central – cortical centers (occipital cortex)



The visual analyzer



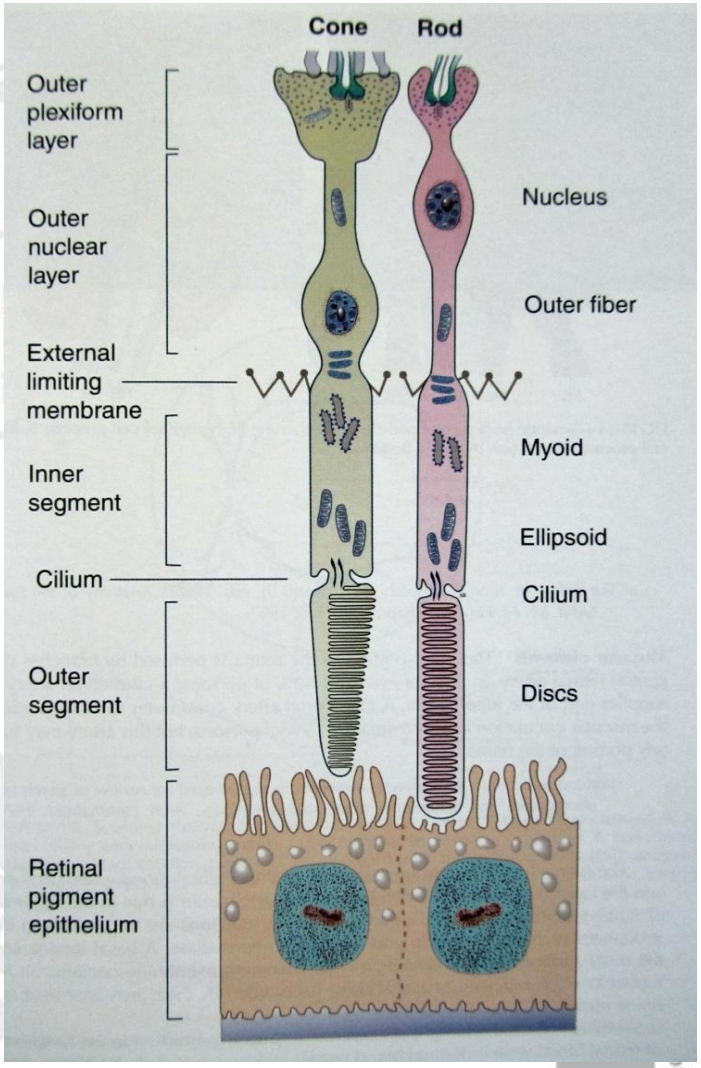
[Jonathan D. Trobe. The Physician's Guide to Eye Care. American Academy of Ophthalmology. 1993]

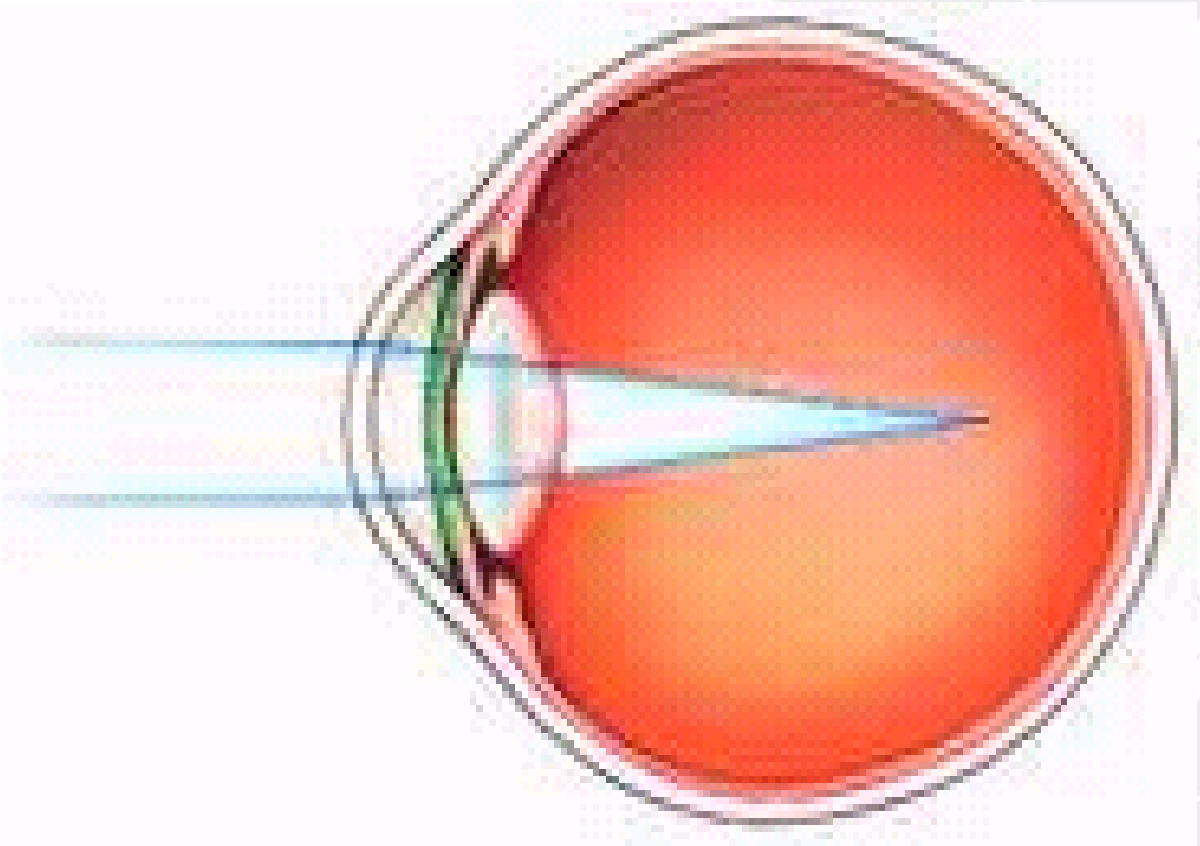
Physiology of the vision

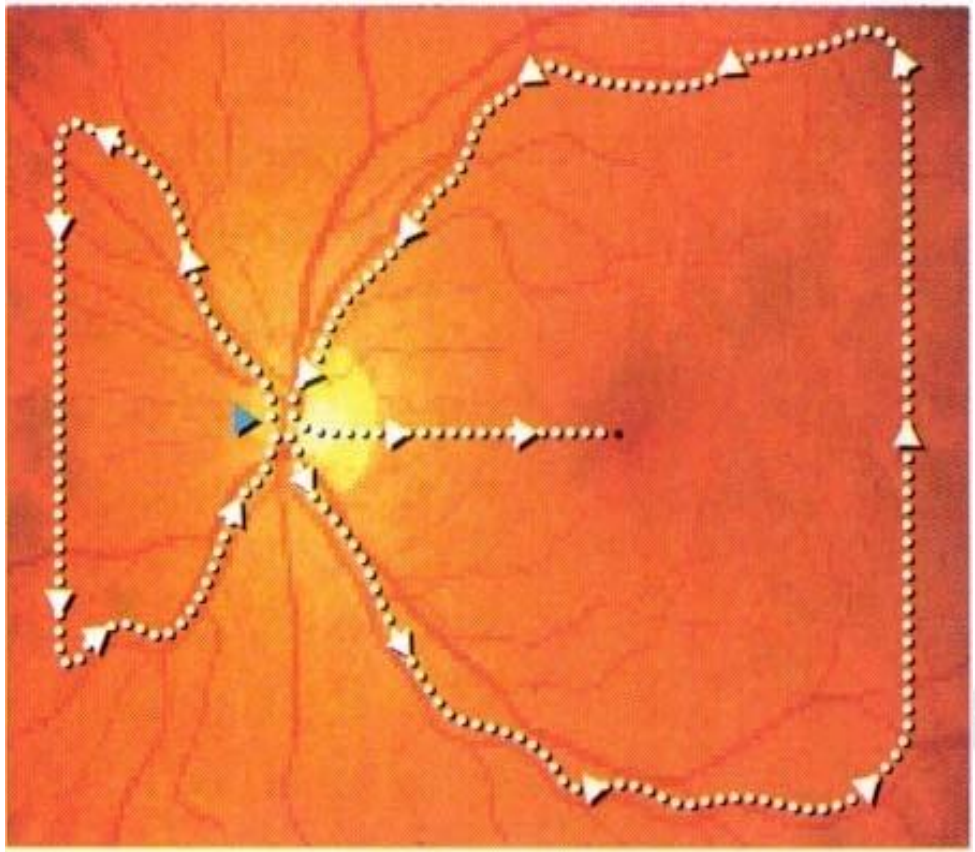
1. The eye optical system focused the image on the retina.
2. Photochemicals/electricals processes:
   - The light induce decomposition of the visual pigments from cones and rods.
   - Formation of the electrical potential
3. Transmition of the electrical potential by the optic pathway till cortical centers
4. Formation of the image in the cortical centers and in the brain.

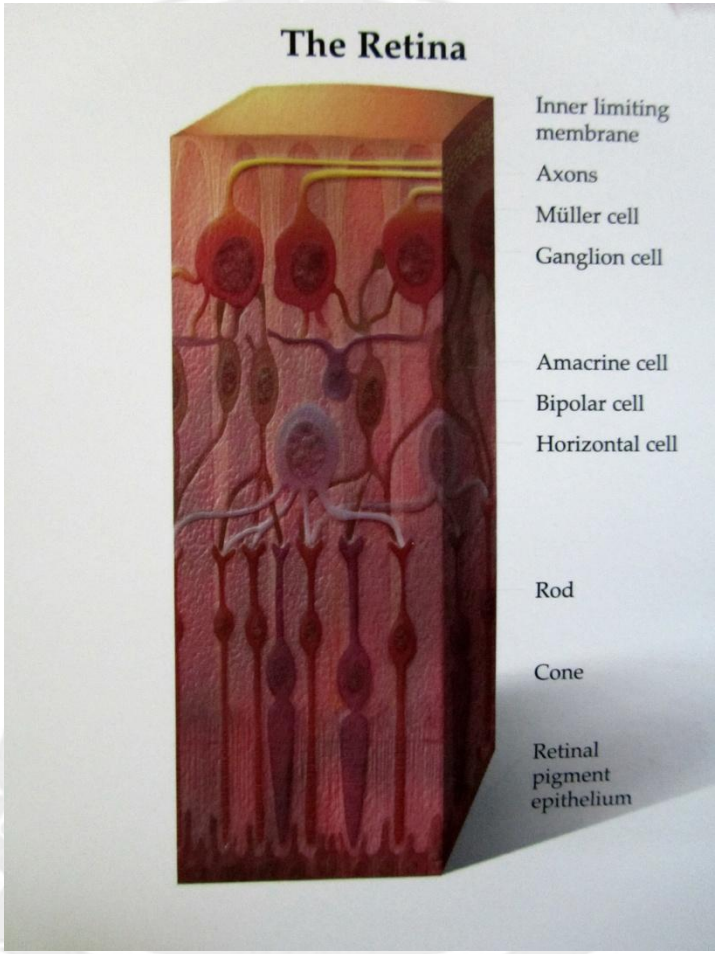
Rods and Cones

- 7 mln cones (in the central of retina), are responsible for daylight vision , pigment – iodopsin
- 130 mln rods (they form the large majority of photoreceptors in the remaining retina), are responsible for night vision, pigment – rodopsin

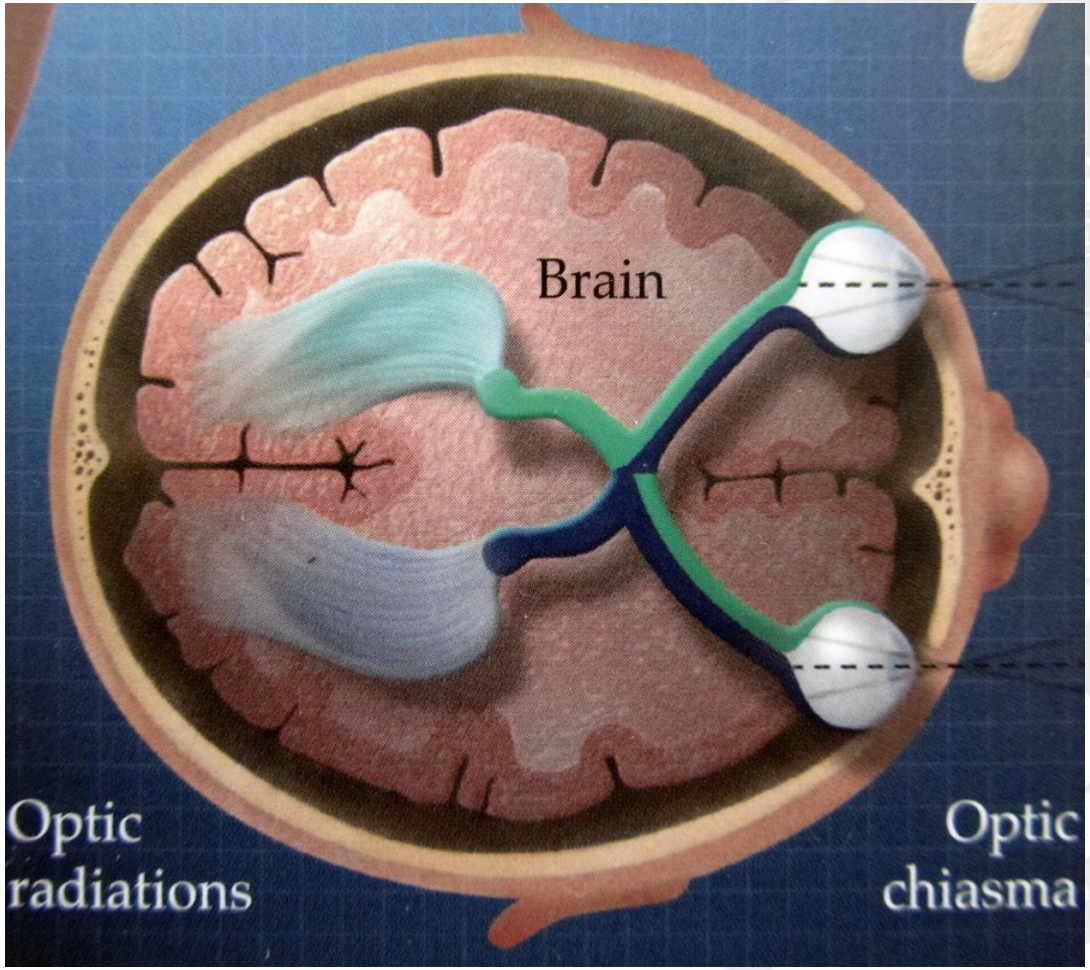







The Retina
Inner limiting membrane
Axons
Müller cell
Ganglion cell
Amacrine cell
Bipolar cell
Horizontal cell
Rod
Cone
Retinal pigment epithelium

The visual perception



Visual functions

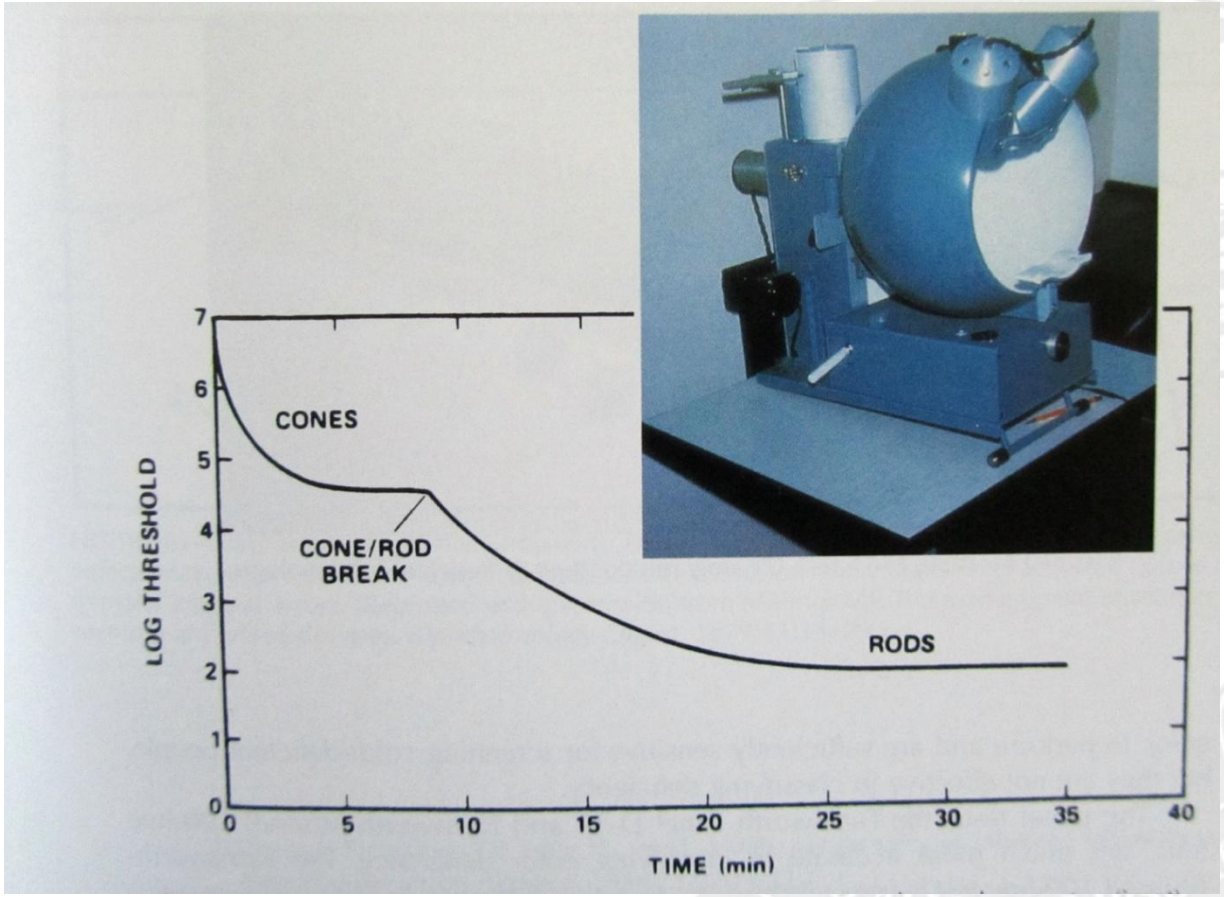
- Light sensation (photosensibillity)
- Form sensation:
  - Central vision
  - Peripheral vision
- Chromatic sensation (Color vision)
- Binocular vision

Photosensibillity
(light perception)

- Essential function
- Rods are more sensitive then cons.

  For stimulate the rods are enough some photons
- Adaptation:
  - To light – 1-3 min
  - To dark – 40-60 min, dereglation - hesperanopies (hemeralopies)

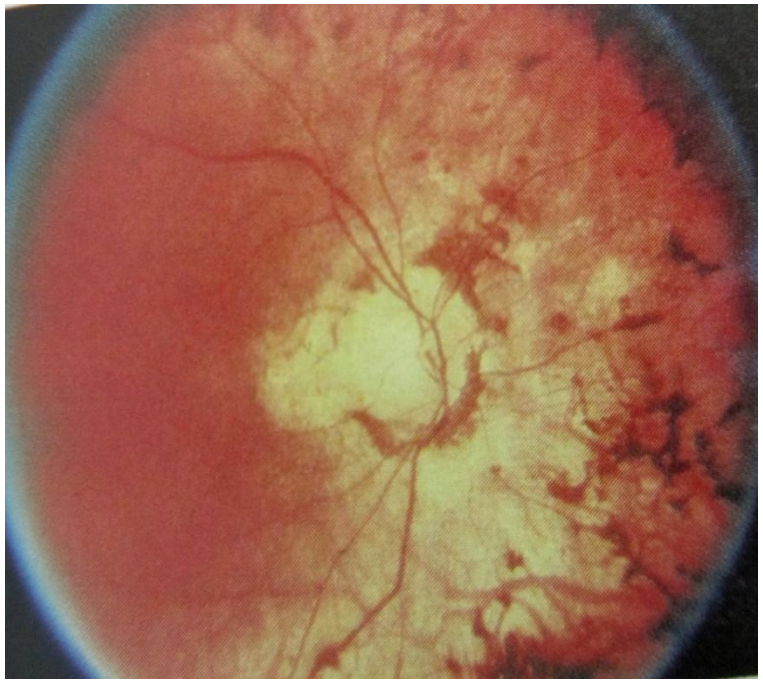
Goldmann-Weekers Adaptometer



Hesperanopies:

- General pathology
  - Insufficiency of vitamine (Vit A)
  - Gastrointestinal, hepatic diseases
  - Renale pathologies
  - Diabet
  - Blood pathologies
- Ocular pathology:
  - Affection of the retina (corioretiniens, vitreoretiniens degenerations)
  - Congenitale functional diseases
  - Affection of the optical ways

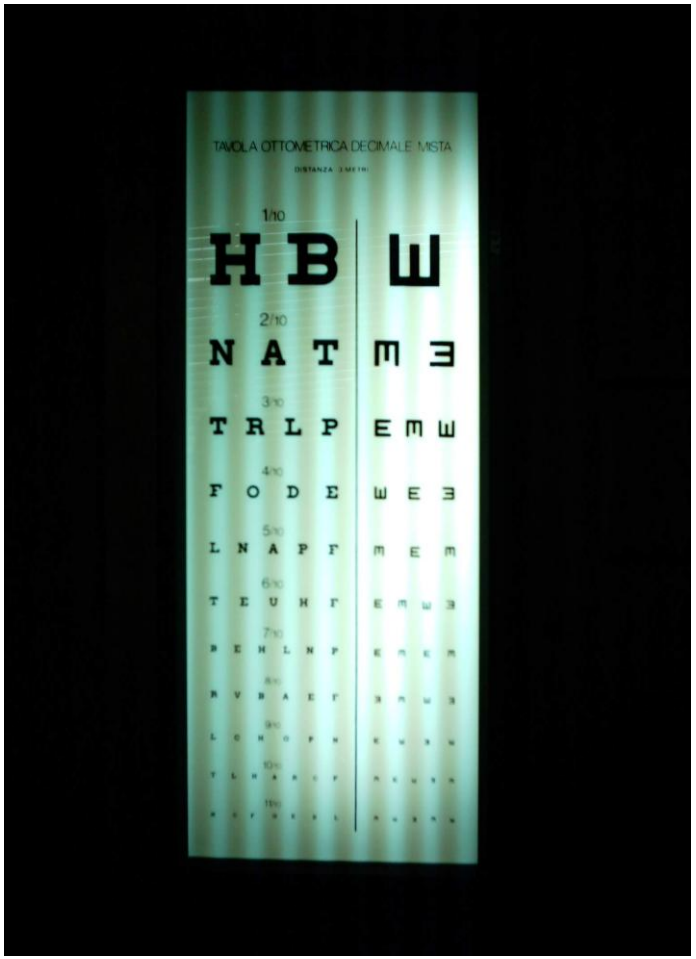
Retinitis pigmentosa



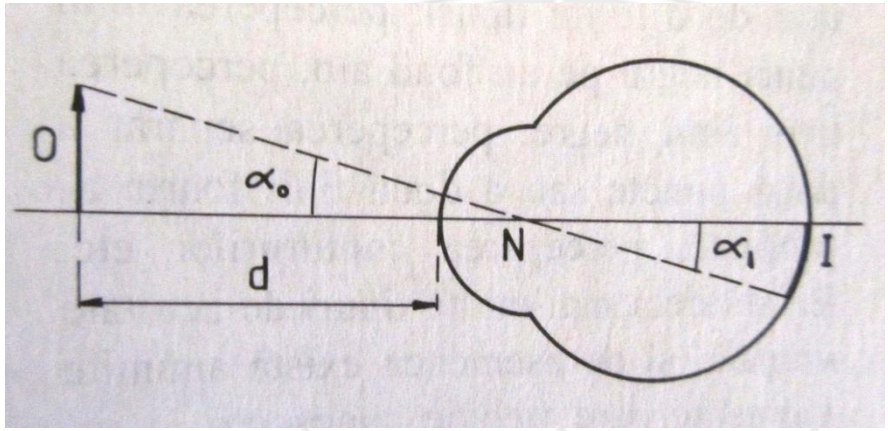
Central vision

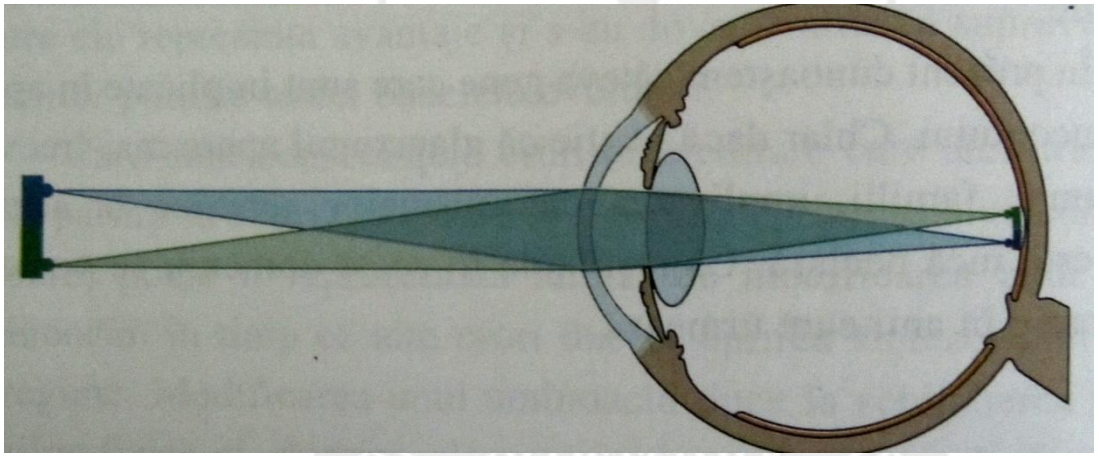
- Capacity of the eye to distinguish the form, contours and details of objects
- This function is assured by cones (macula)
- Consist in **visual acuity** (VA)

The illuminated Snellen chart

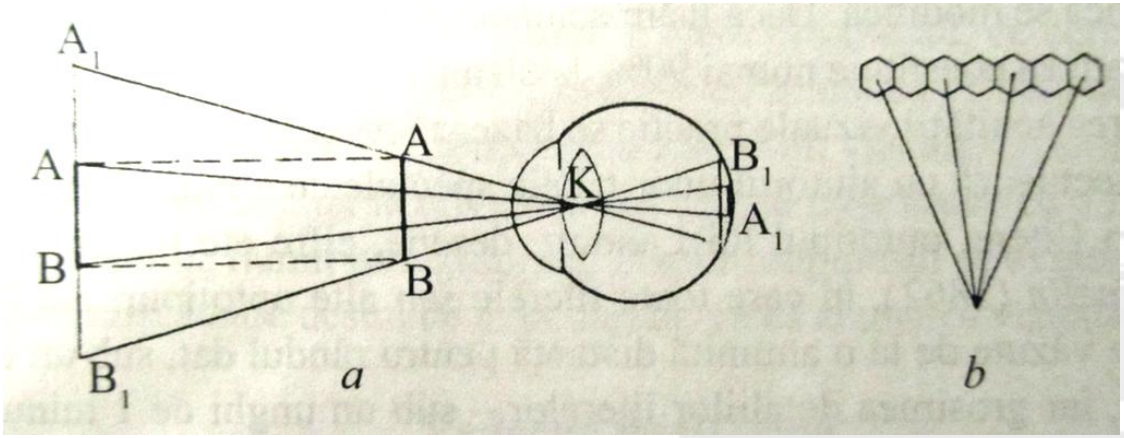


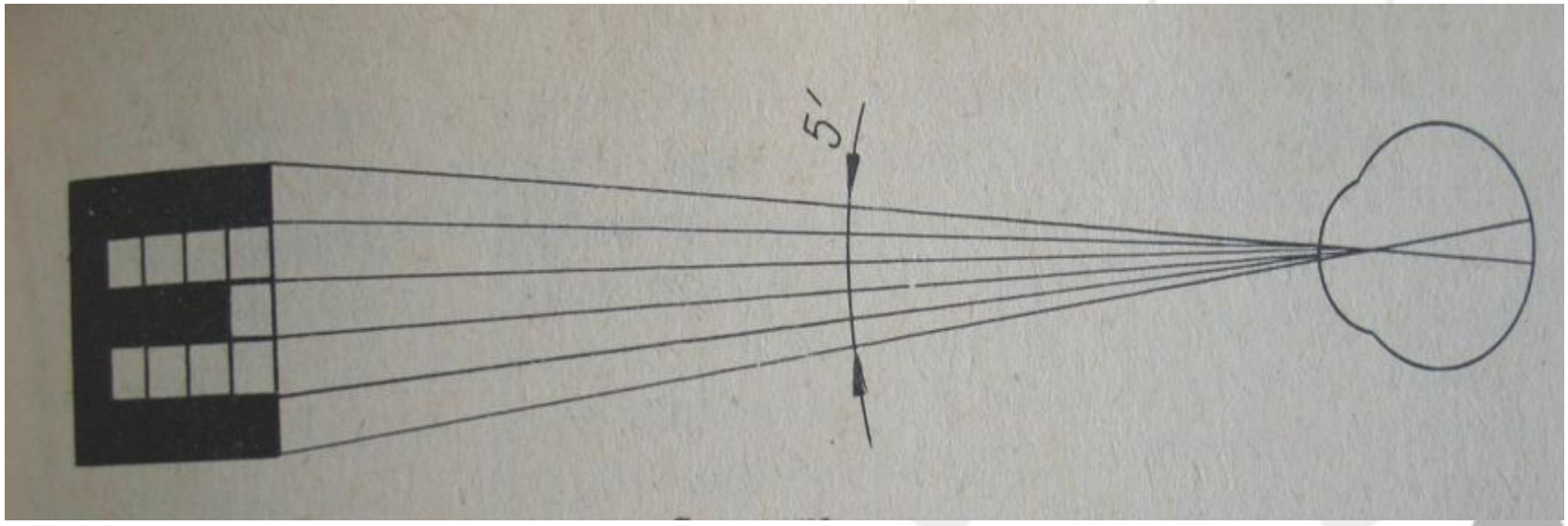
Each row is numbered with the distance in metres (feet) at which each letter width subtends 1 minute of arc at the eye.





VA (vis) = $1/\alpha$

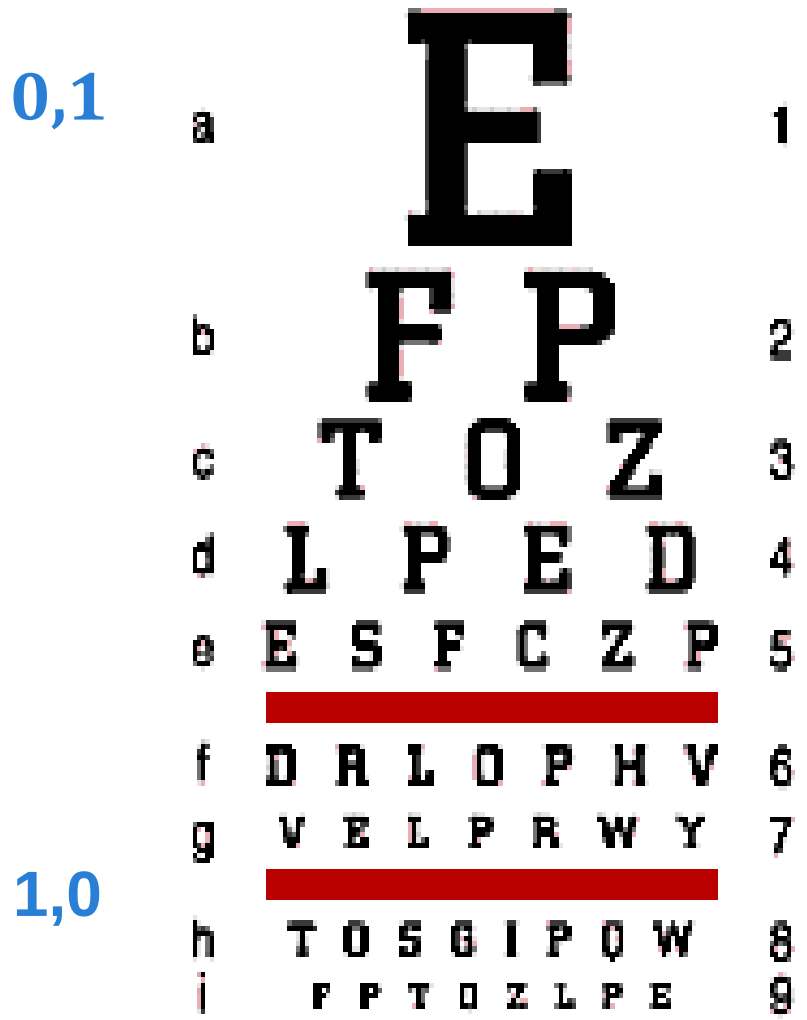

A1
A
B
B1
A
B
K
B1
A1
a
b


5'

Visual acuity appreciation
The Snellen chart

VA is recorded as the reading distance (e.g. 6 m (20 feet) or 5 m) over the row number, of the smallest letter seen.

VA (vis) = d/D

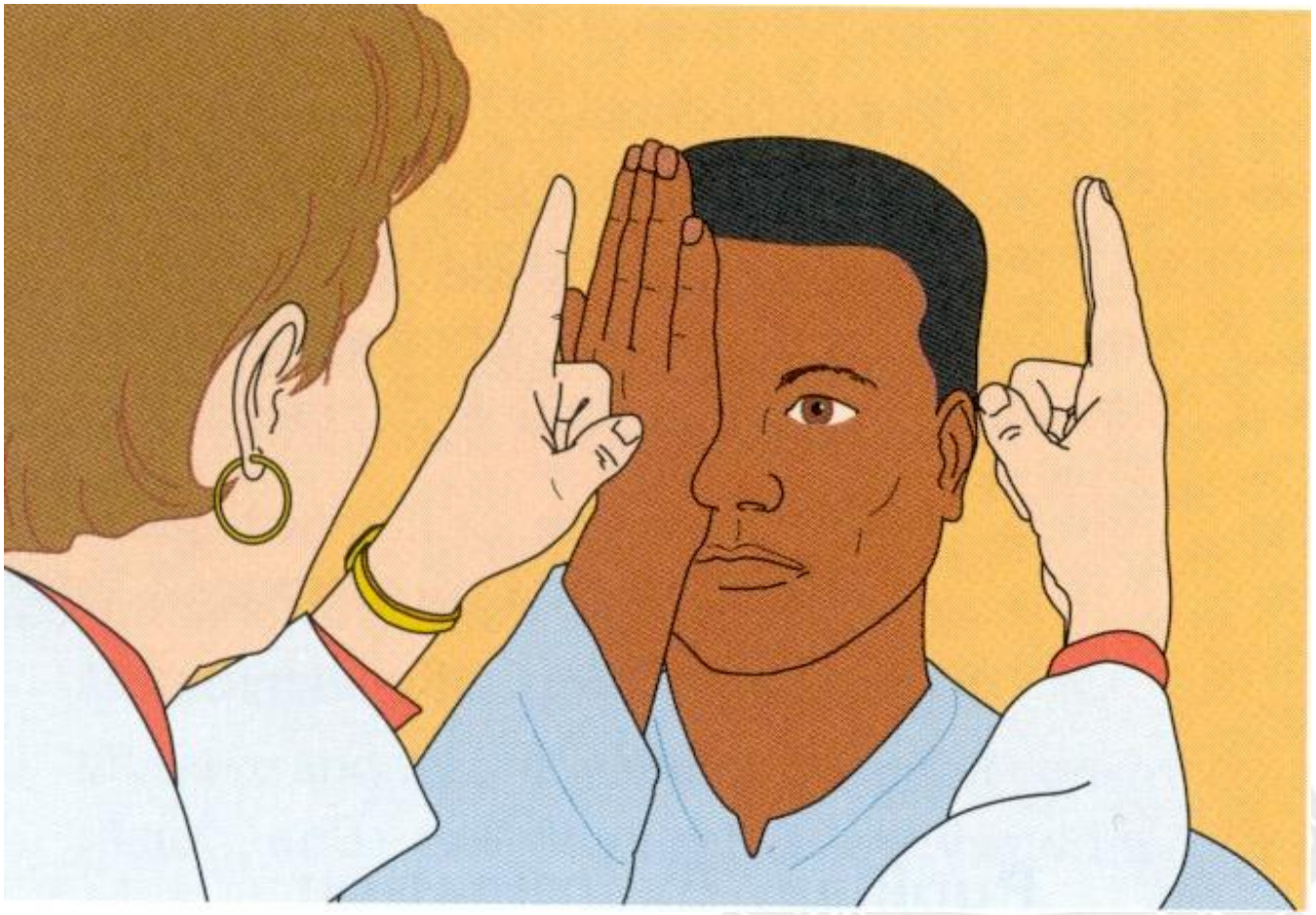


The chart for appreciation of visual acuity for children

Peripheral vision

- The totality of the space points concomitant perceived by sensorial retina
- It is assured by the activity of all photoreceptors (cones, rods)
- Is evaluated by assessing of visual fields

Methods of assessing visual fields *(Donders)(confrontation tests)*



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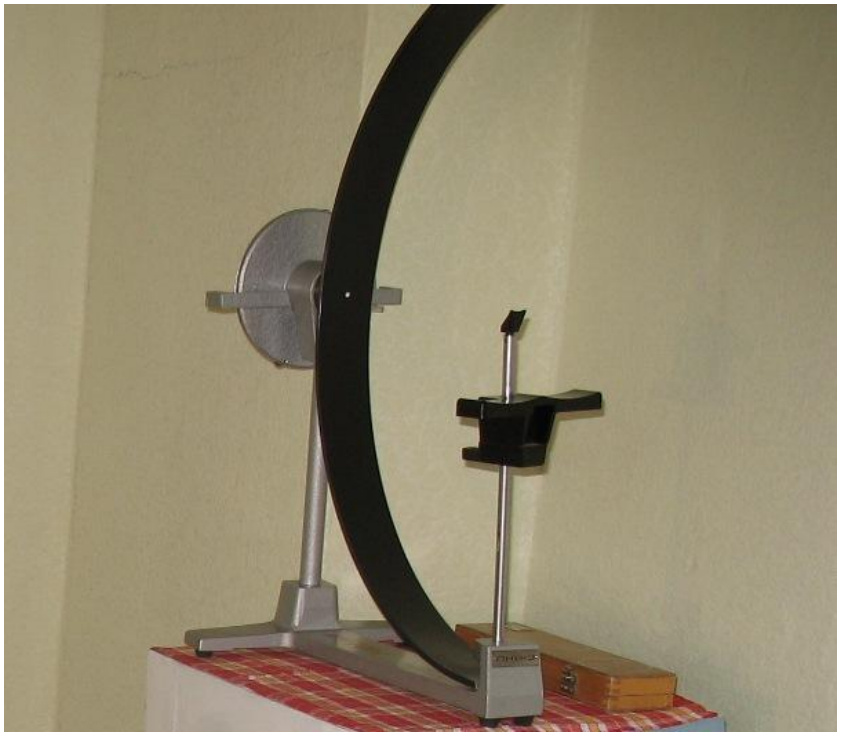
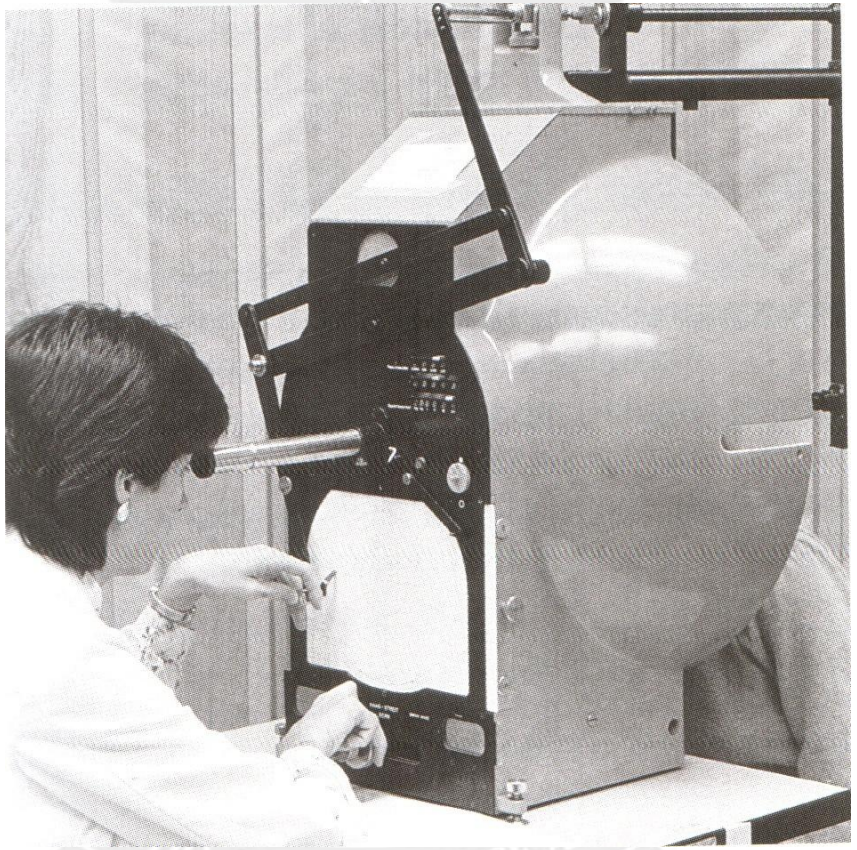
The Ferster Perimeter



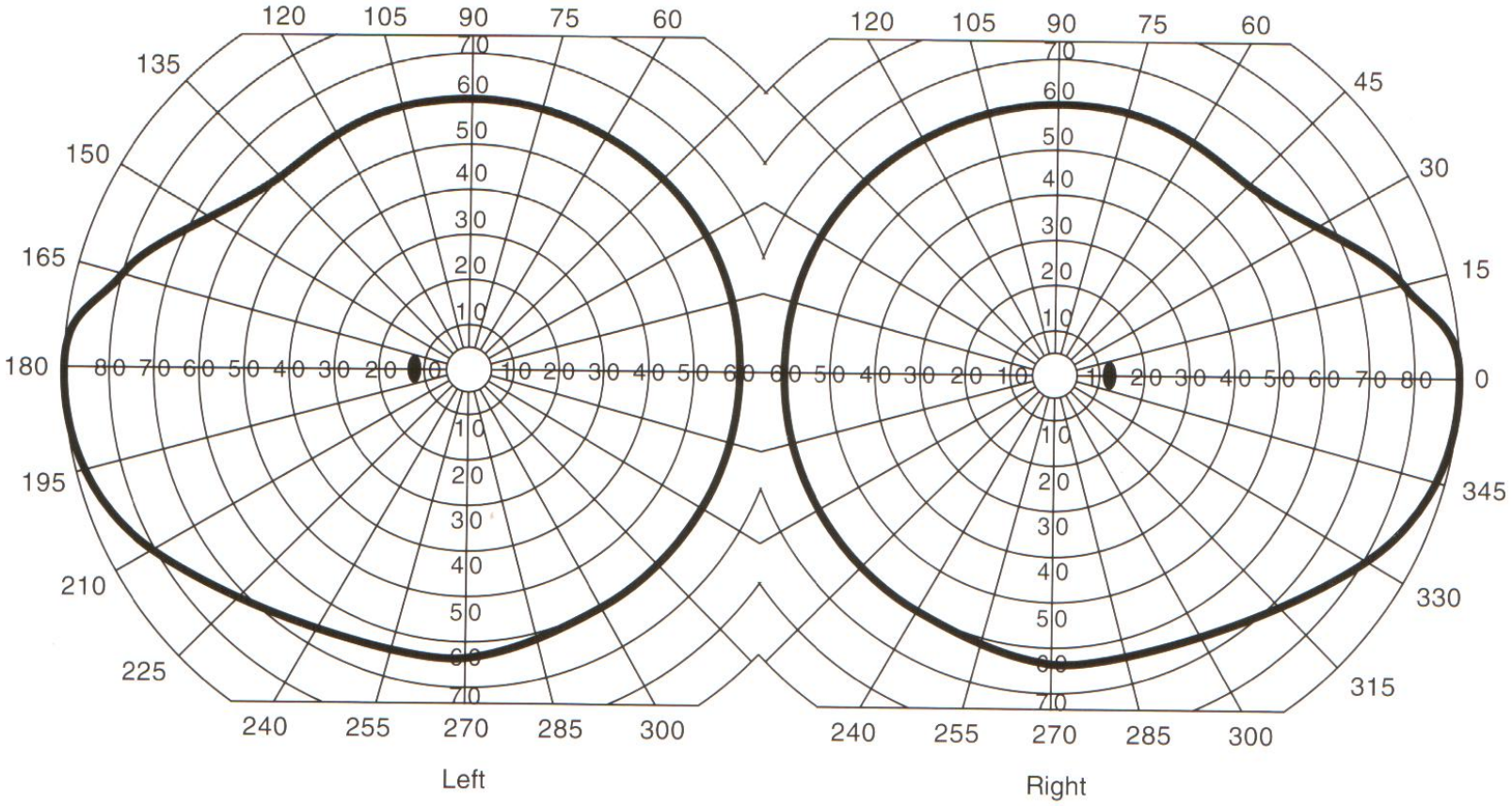
The Perimeter of light projection

Spheroperimeter

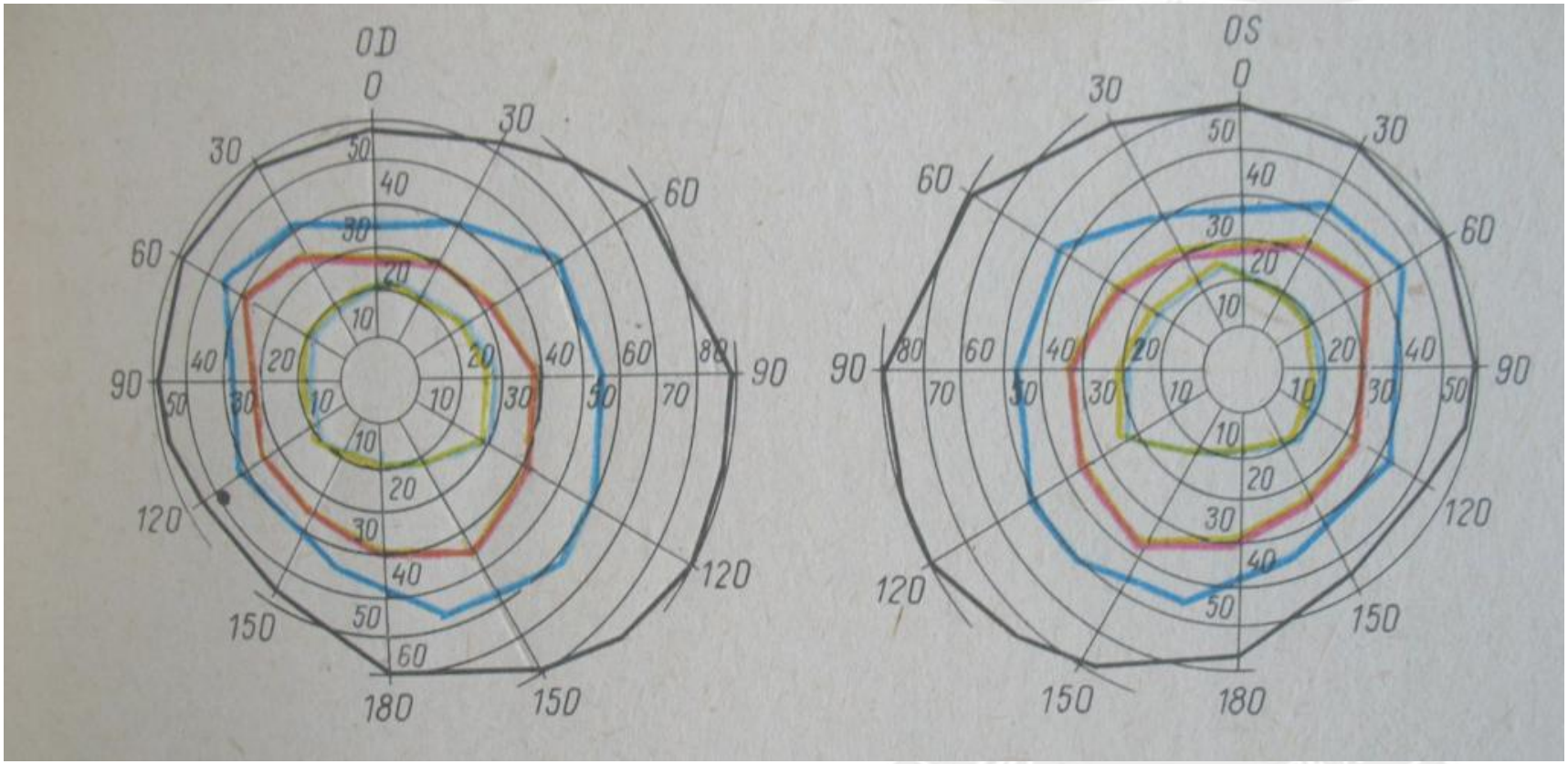


The Humphrey Perimeter

The normal limits of visual field (white light)

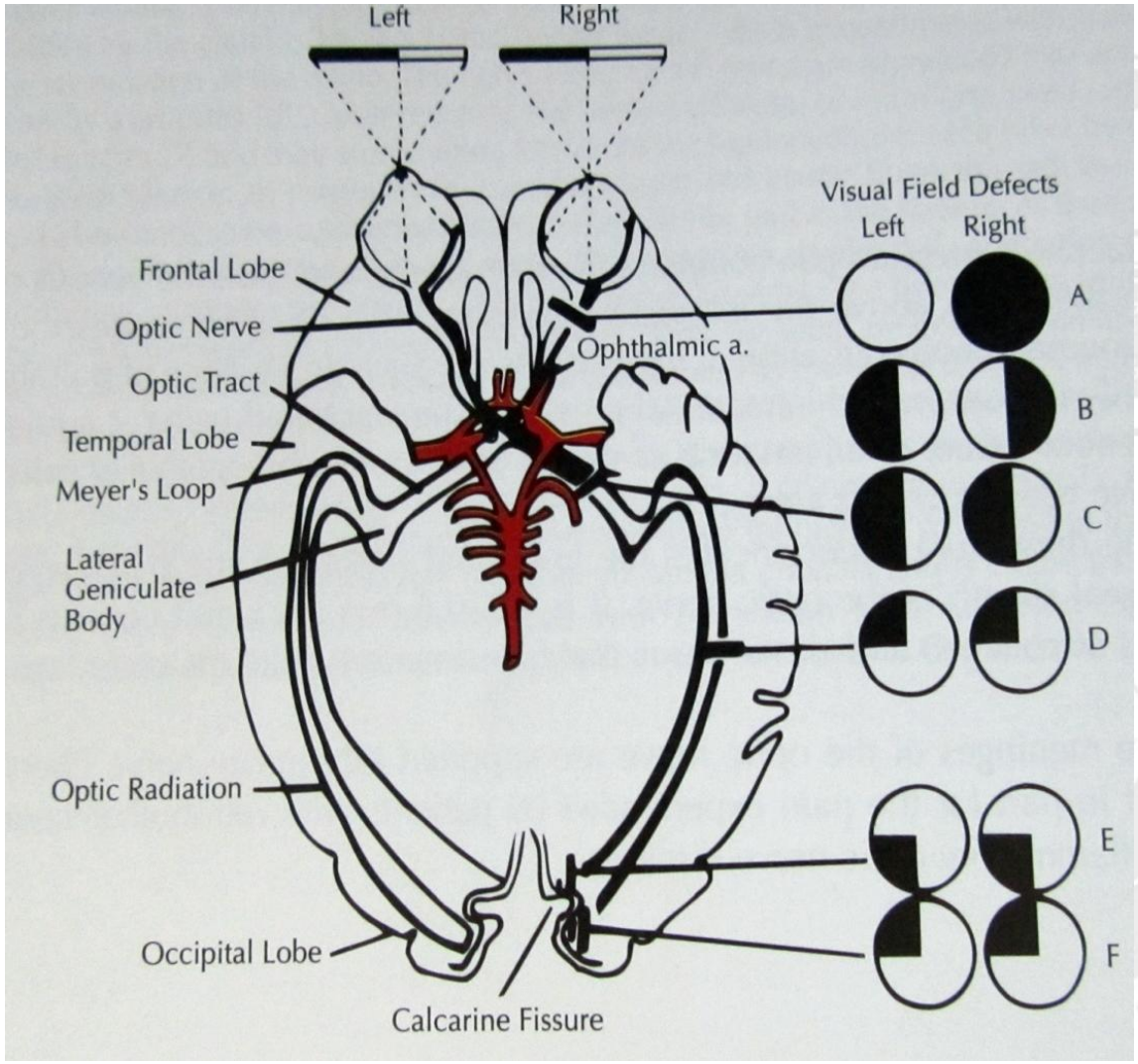


The normal limits (isoptres) of visual field (of colors)

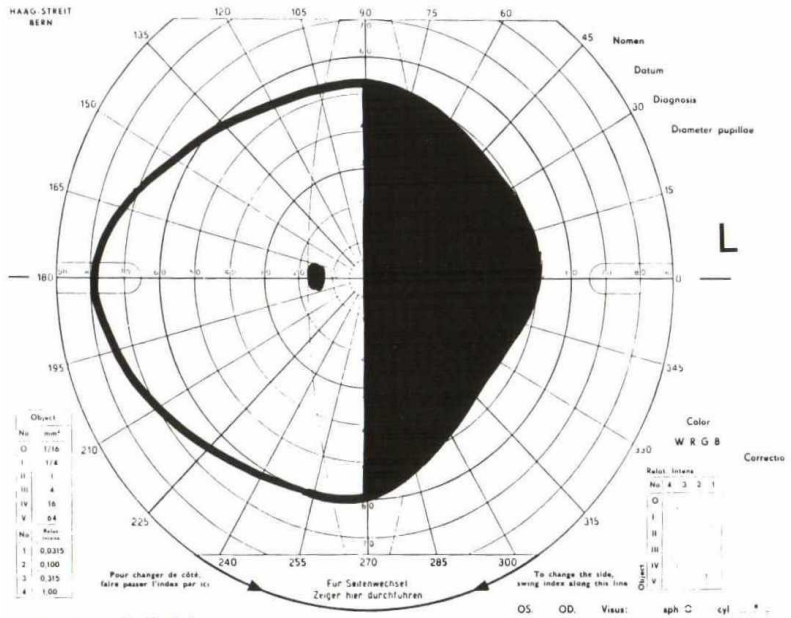


The visual fields disturbances

- Loss:
  - peripherical
  - sectorial
  - hemianopsies
- Defects (scotoms):
  - positiffe, negative
  - absolut, relatives

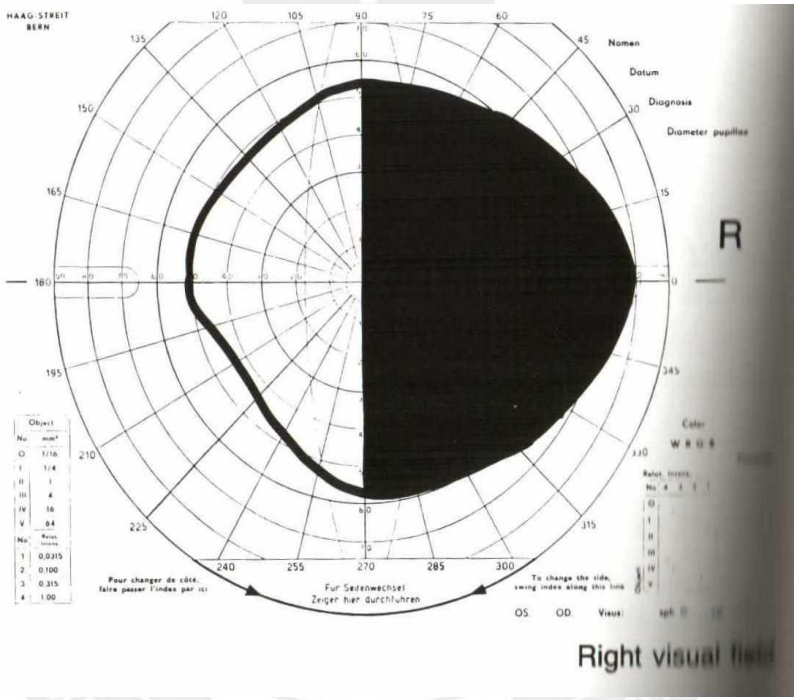

Left
Right
Visual Field Defects
Left
Right
Frontal Lobe
Optic Nerve
Optic Tract
Temporal Lobe
Meyer's Loop
Lateral Geniculate Body
Optic Radiation
Occipital Lobe
Calcarine Fissure
Ophthalmic a.
A
B
C
D
E
F

Right congruous (homonyms) hemianopia



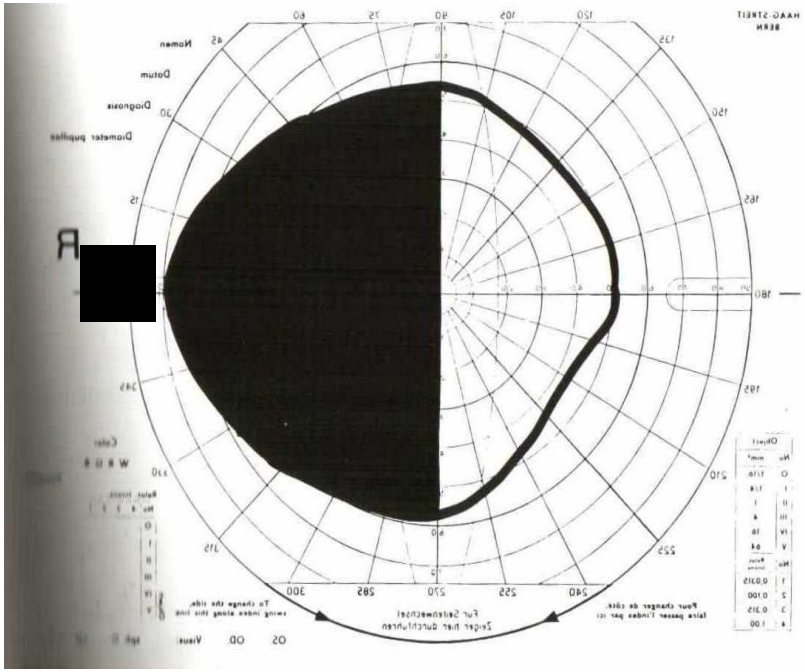
Left visual field

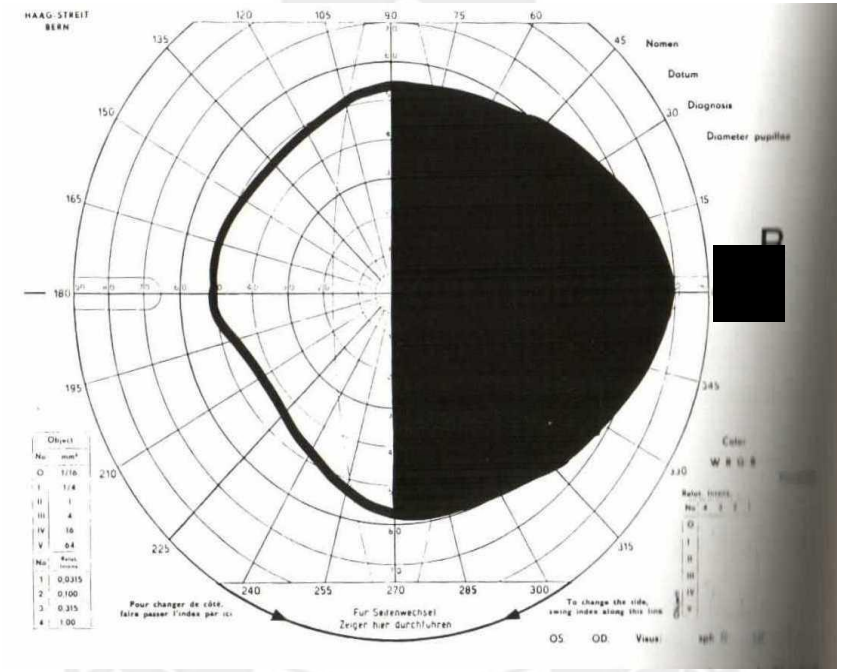
Fig. 16. Homonymous right hemianopia.



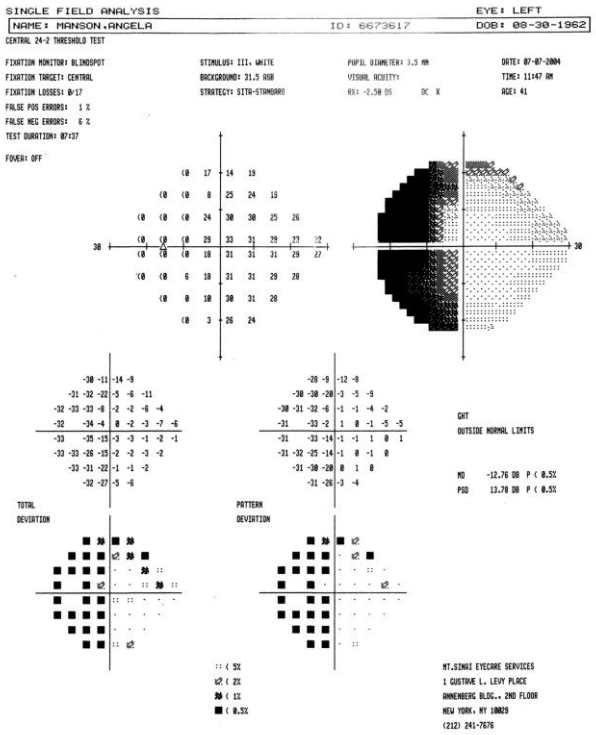
Right visual field

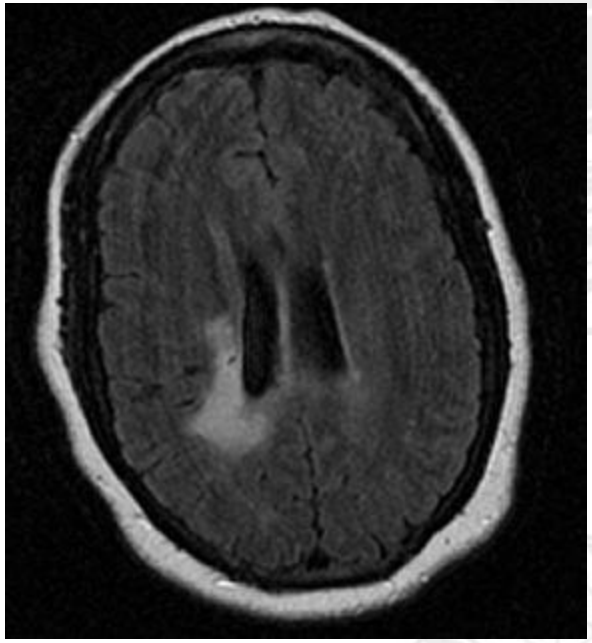
Bitemporal hemianopia (heteronyms)

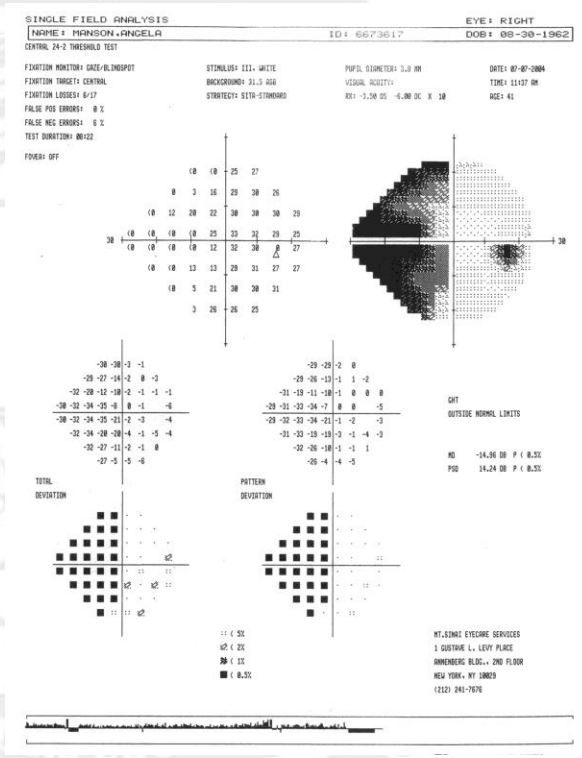




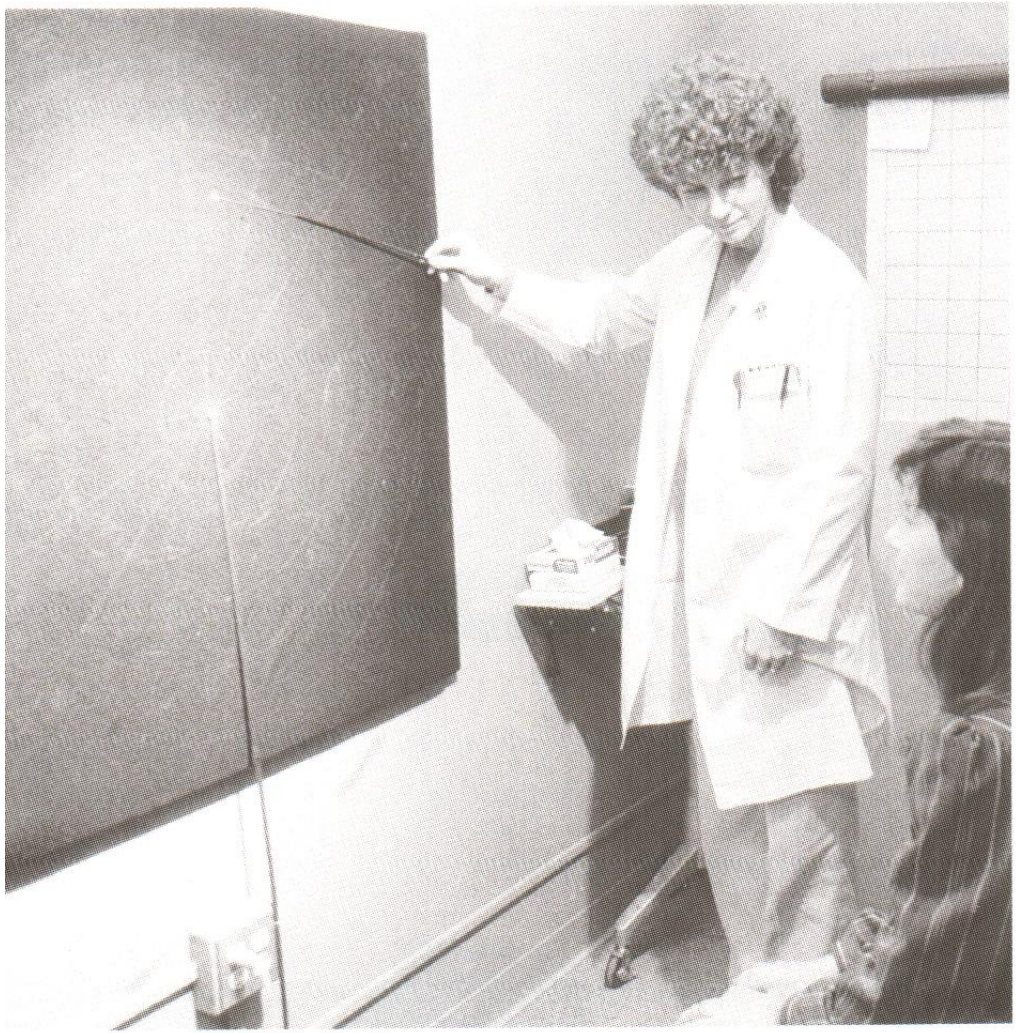
Homonyms hemianopia and CT image of placement of cerebral pathology (infarct)







Campimetry



Color vision

- The propriety of perception of different wave lengths (red, green, blue light)
- It is assured by cones
- The trichromatic theory Young-Helmholtz, Lomonosov: 3 typs of cones receptors adaptate to 3 fundamental color – red, green, blue

Color proprieties:

- Tonality (depend of the wave lengths)
- Saturation – the part of the same wave lengths in the color
- Luminozity – the part of the white light in the color

Methodes of examination of the color vision

- Color vision tests:
  - nomination
  - matching and clasification
  - confusion or discrimination
  - equalization

Pseudoisochromatic tables

Color vision defects

- Congenitals (sex-linked heredity):
  - male 4-8%,
  - female 0-4%
- Obtained (secondary):
  - in optic nerv pathology (neuritis, neurophaties) –red-green disturbances
  - In retinal pathology (RD, DR, MF, maculophaties) yellow-blue disturbances

Congenital color vision defects

- Anomal trichromatopsia:
  - Protanomalia > 1 %
  - Deuteroanomalia 4 %
  - Tritanomalia 0,001 %
- Dichromatopsia:
  - Protanopia (Dalton anomaly) > 1 %
  - Deuteroanopia (Nagel anomaly) > 1 %
  - Tritanopia
- Monocromasia
- Acromatopsia

Chromatopsies

- Perception in:
  - red – **Eritropsia** –intravitreene hemoragies
  - yellow– **Xantopsia** – intoxications
  - green– **Cloropsia** – intoxications
  - blue– **Cianopsi**a – afakia
  - violet – **Iantinopsia** – intoxications (marihuana, mushrooms)