

M U N I

M E D

**M U N I**  
**M E D**

**10**

**Zrak II**

# Vytváření obrazu

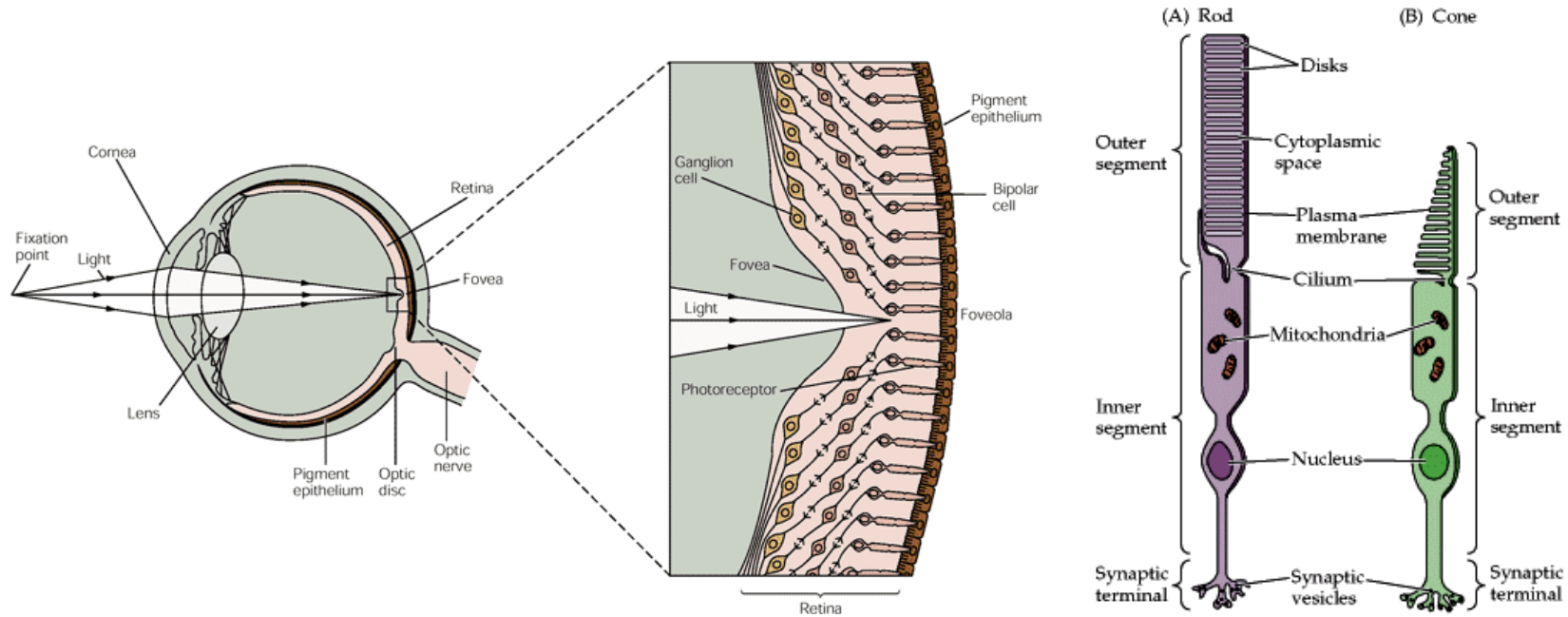
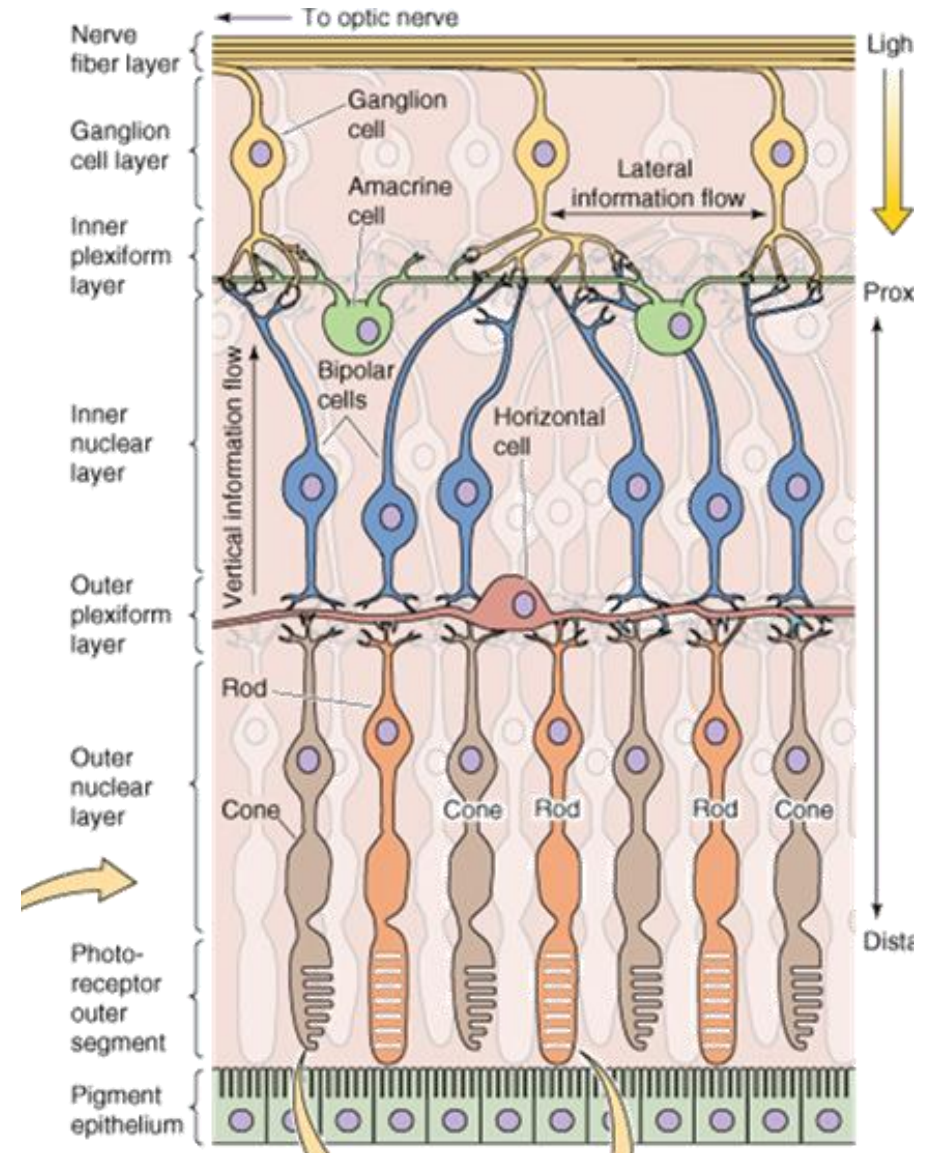


Table 26-1 Differences Between Rods and Cones and Their Neural Systems

Rods	Cones
High sensitivity to light, specialized for night vision	Lower sensitivity, specialized for day vision
More photopigment, capture more light	Less photopigment
High amplification, single photon detection	Lower amplification
Low temporal resolution: slow response, long integration time	High temporal resolution: fast response, short integration time
More sensitive to scattered light	Most sensitive to direct axial rays
<b>Rod system</b>	<b>Cone system</b>
Low acuity: not present in central fovea, highly convergent retinal pathways	High acuity: concentrated in fovea, dispersed retinal pathways
Achromatic: one type of rod pigment	Chromatic: three types of cones, each with a distinct pigment that is most sensitive to a different part of the visible light spectrum

# Sítnice

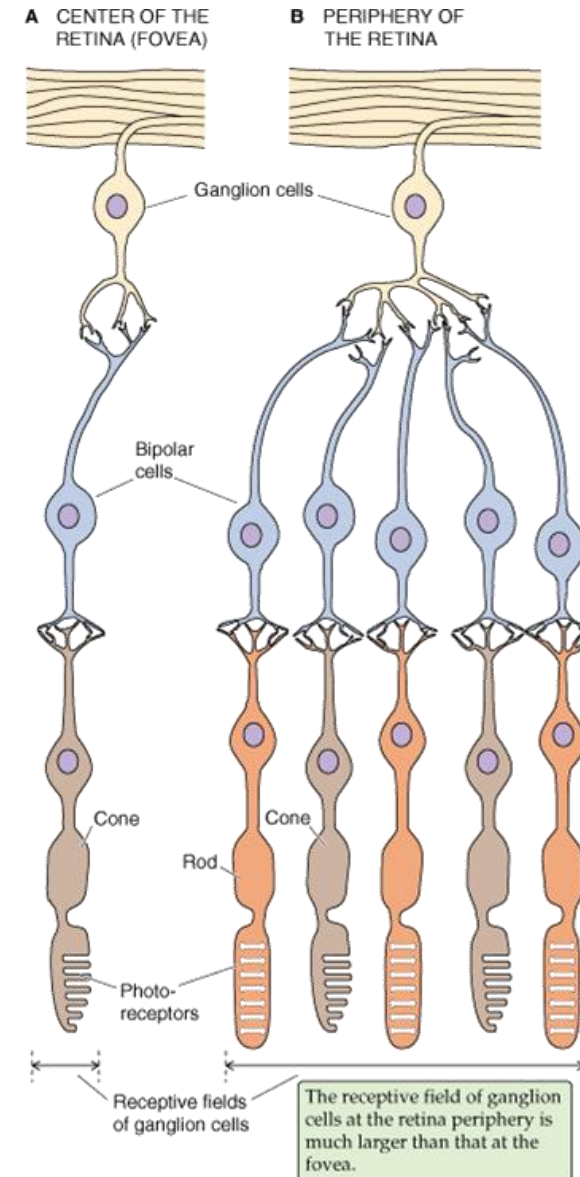
- Fotoreceptory
- Interneurony
  - Horizontální buňky
    - Horizontální propojení
  - Bipolární buňky
    - Vertikální propojení
  - Amakrinní buňky
    - Horizontální i vertikální propojení
- Gangliové buňky
  - Tvorba AP
  - Transmise AP do mozku



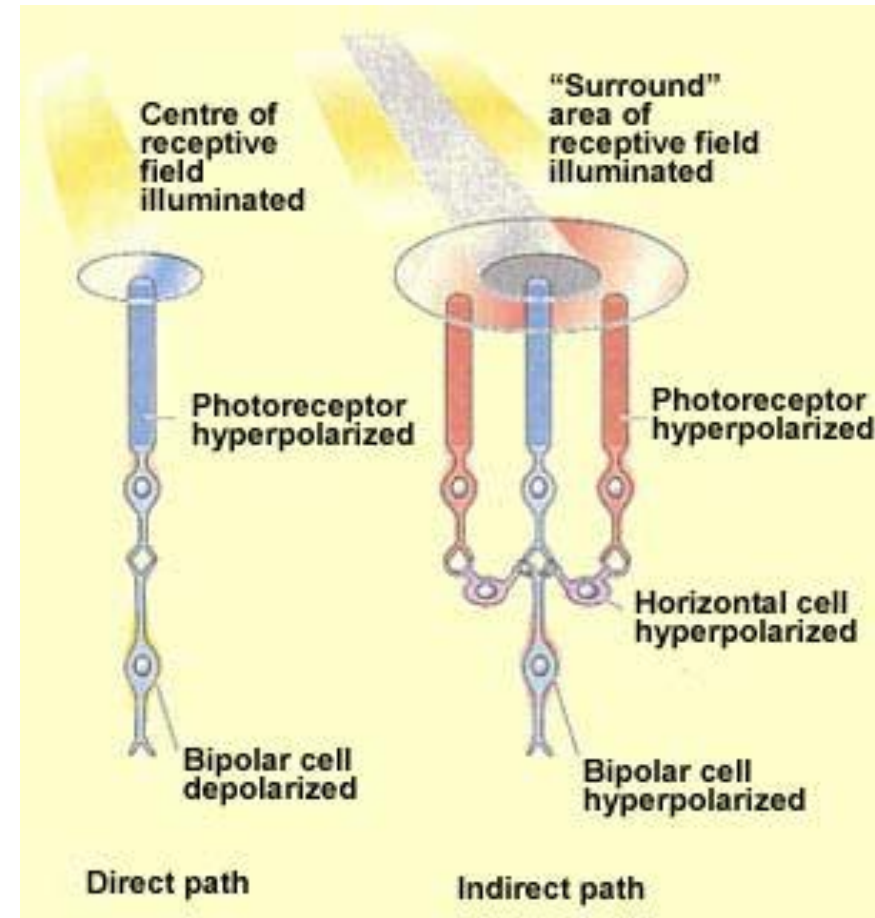
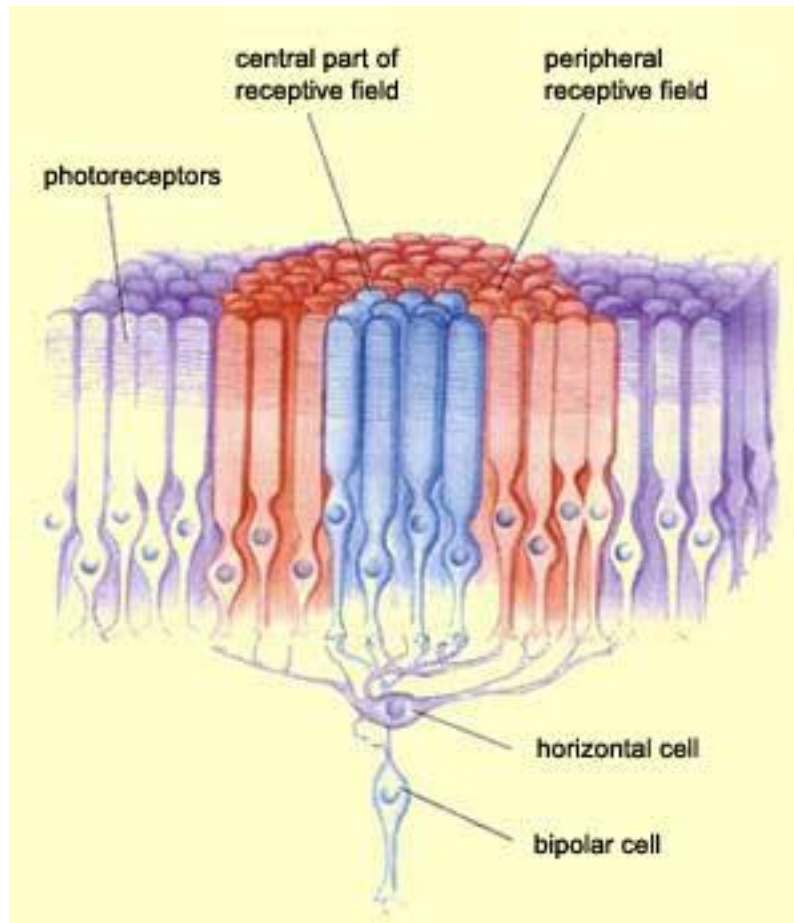
<http://www.slideshare.net/CsillaEgri/presentations>

# Sítnice

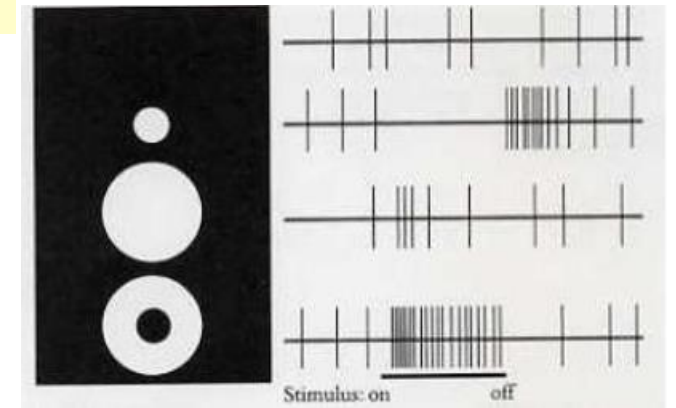
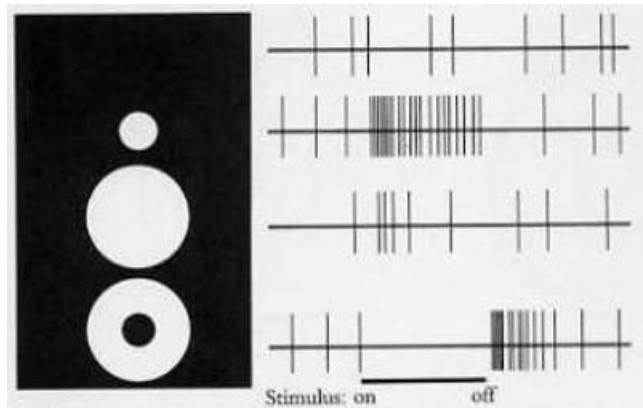
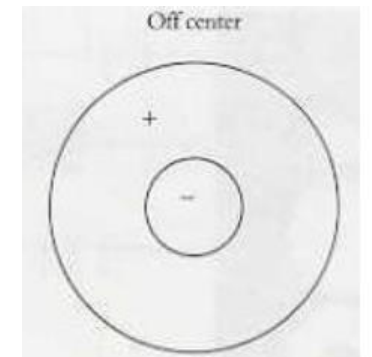
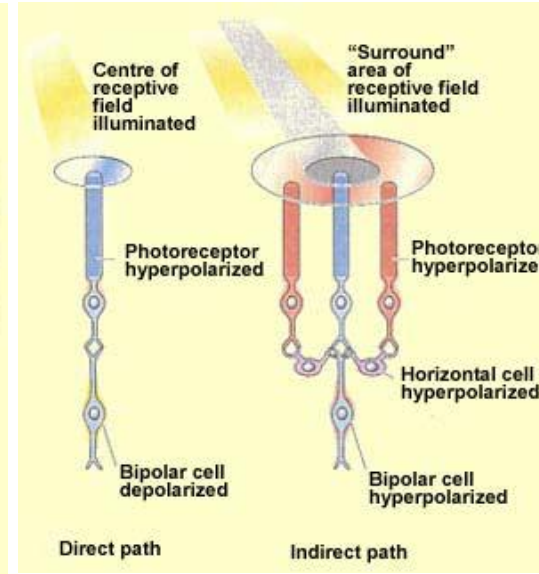
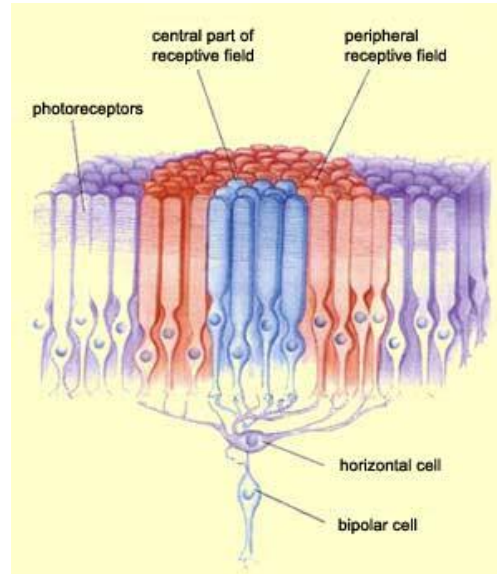
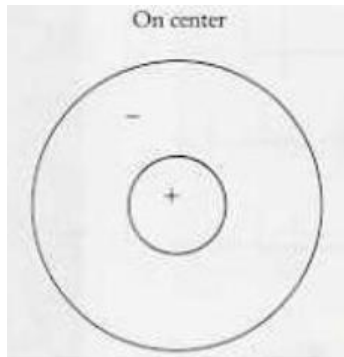
- Fovea
  - Malá konvergence signálu
    - Malé receptivní pole
    - Vysoké rozlišení
  - Malá senzitivita ke světlu
- Periferie sítnice
  - Velká konvergence signálu
    - Velké receptivní pole
    - Nízké rozlišení
  - Vysoká senzitivita ke světlu



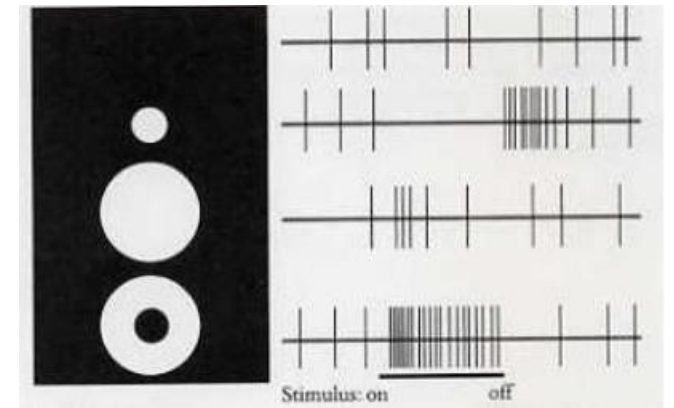
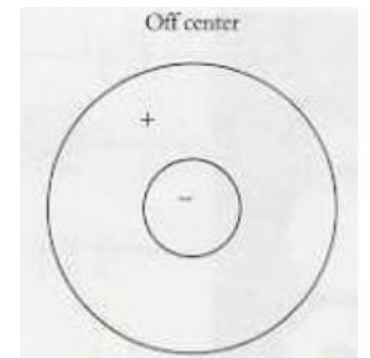
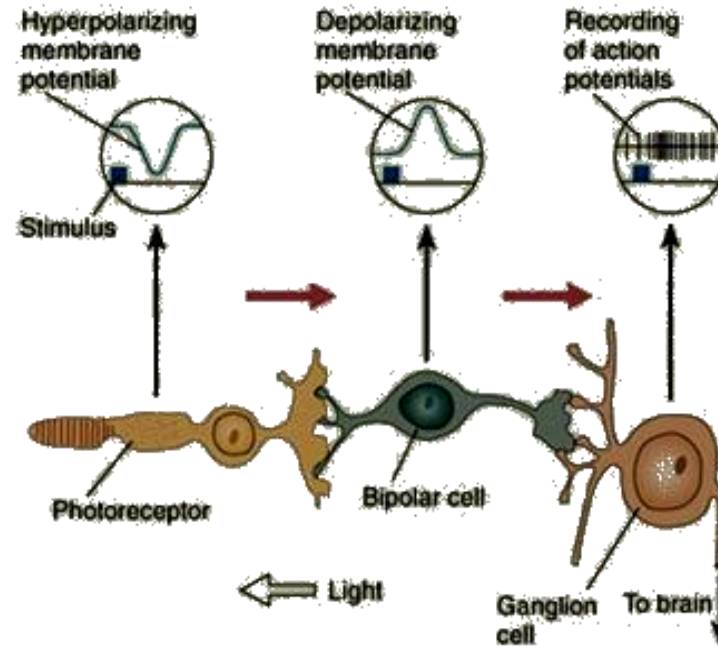
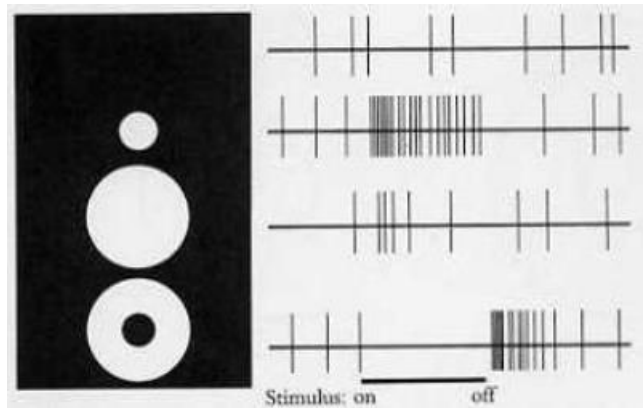
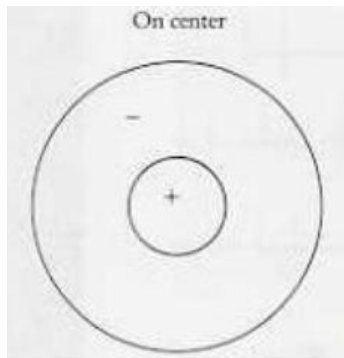
# Receptivní pole



# Receptivní pole

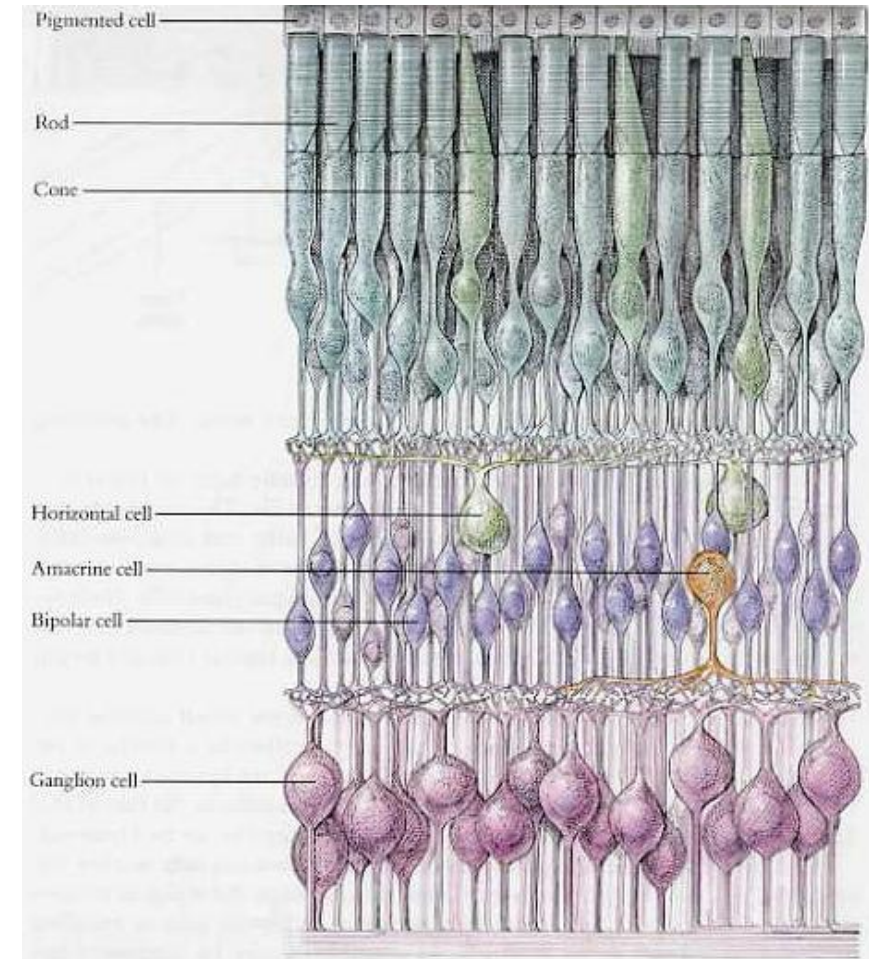
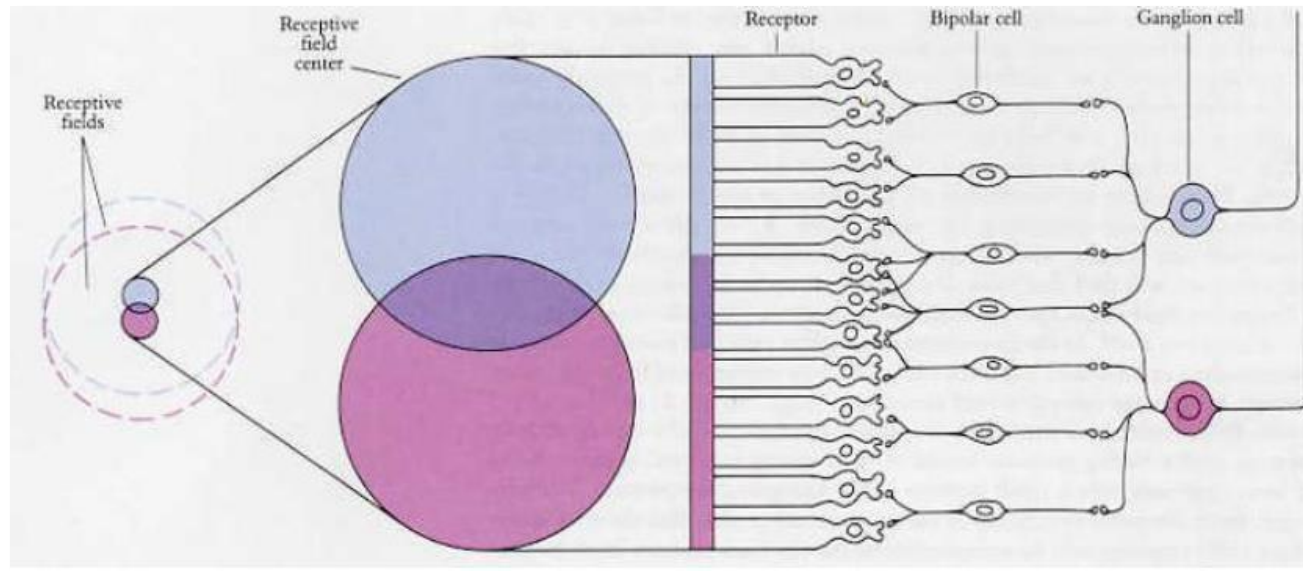


# Receptivní pole





# Receptivní pole

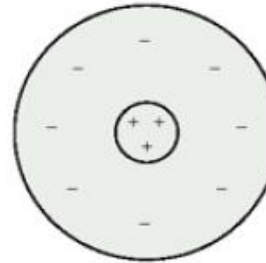


# Receptivní pole

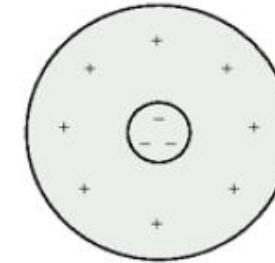
- Magnocelulární systém
  - Velká receptivní pole
  - Tyčinky i čípky
  - **M gangliové buňky (10%)**
  - Vysoká rychlost vedení
  - Dobrá senzitivita na jas/nízký kontrast
  - Minimální senzitivita na barvu

A M cells

On-center

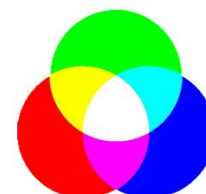
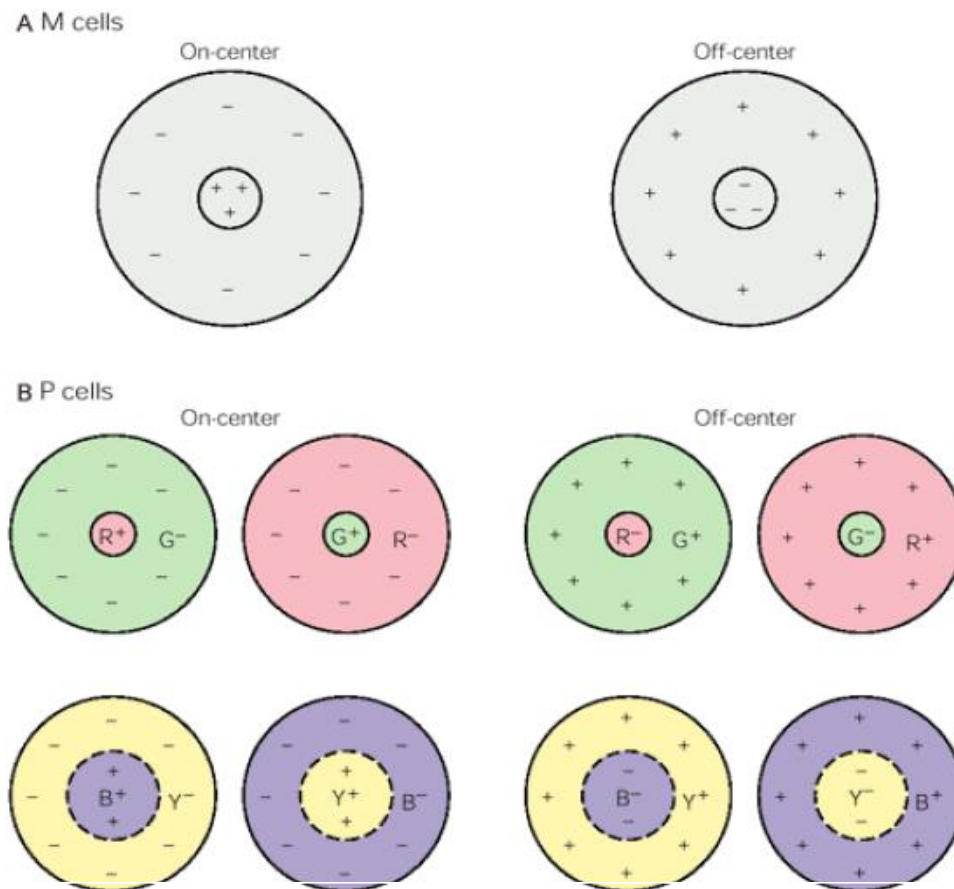


Off-center



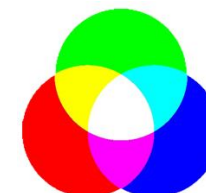
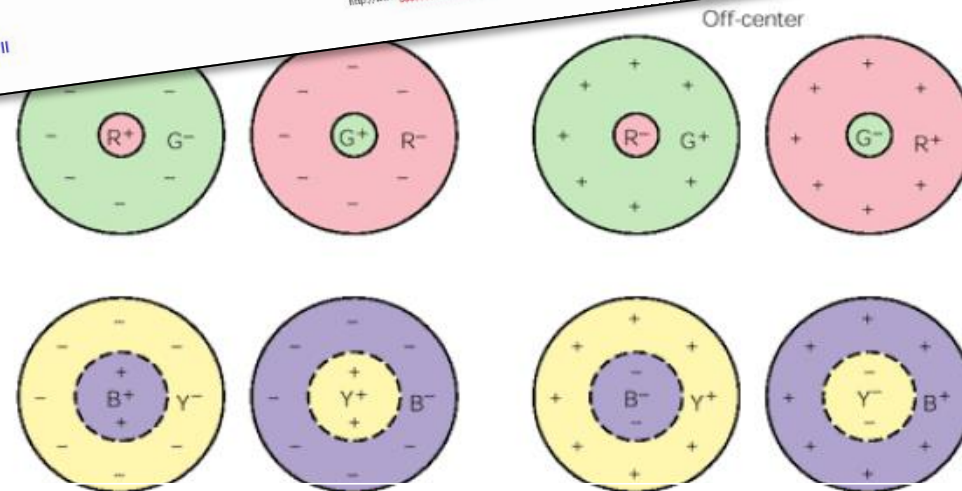
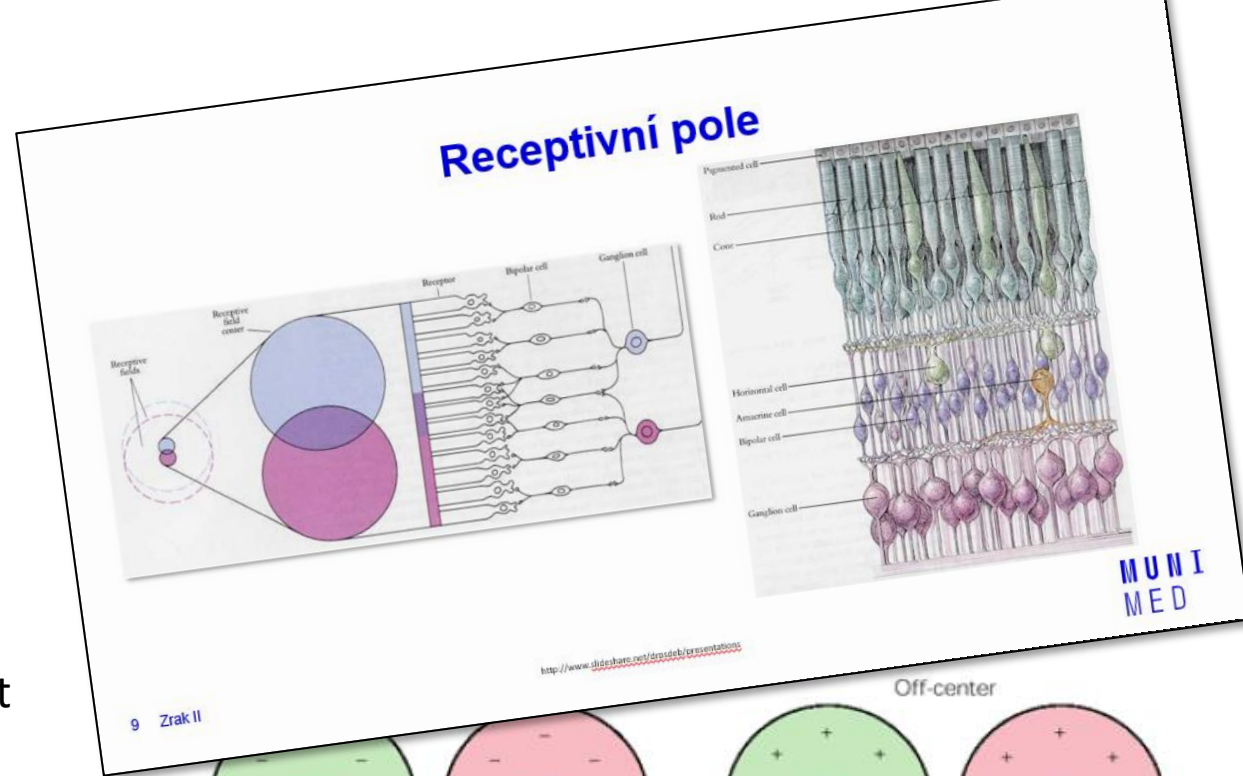
# Receptivní pole

- Magnocelulární systém
  - Velká receptivní pole
  - Tyčinky i čípky
  - **M gangliové buňky (10%)**
  - Vysoká rychlost vedení
  - Dobrá senzitivita na jas/nízký kontrast
  - Minimální senzitivita na barvu
- Parvocelulární systém
  - Malá receptivní pole
  - Čípky i tyčinky
  - **P gangliové buňky (80%)**
  - Pomalá rychlost vedení
  - Špatná senzitivita na nízký kontrast
  - Dobrá senzitivita na barvu



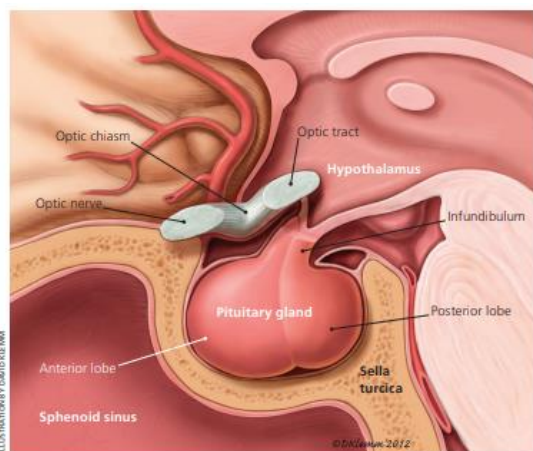
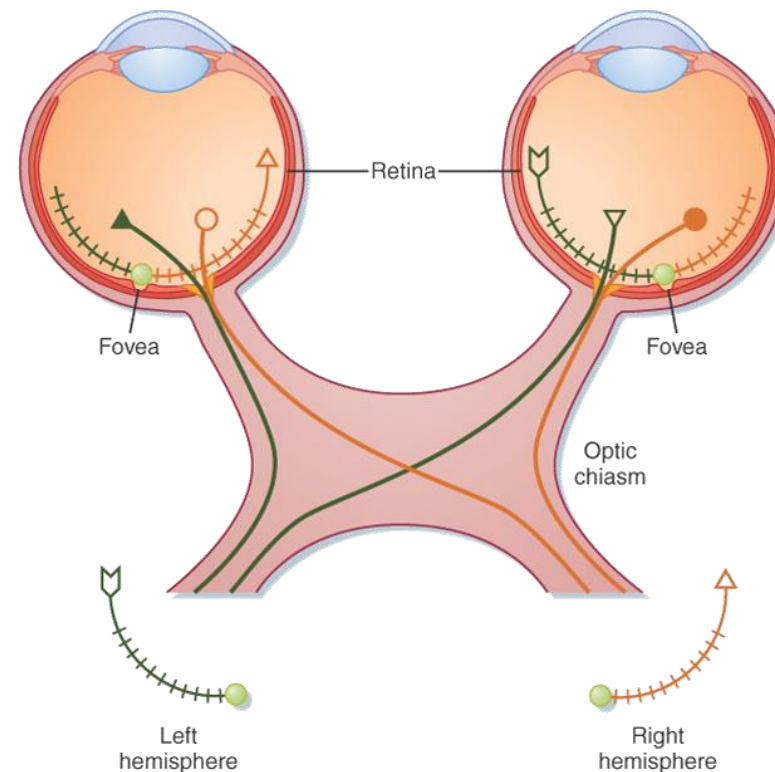
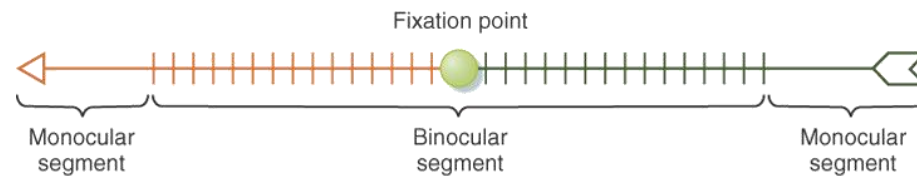
# Receptivní pole

- Magnocelulární systém
  - Velká receptivní pole
  - Tyčinky i čípky
  - **M gangliové buňky (10%)**
  - Vysoká rychlost vedení
  - Dobrá senzitivita na jas/nízký kontrast
  - Minimální senzitivita na barvu
- Parvocelulární systém
  - Malá receptivní pole
  - Čípky i tyčinky
  - **P gangliové buňky (80%)**
  - Pomalá rychlost vedení
  - Špatná senzitivita na nízký kontrast
  - Dobrá senzitivita na barvu



# Nervus opticus a tractus opticus

- Nervus opticus
  - Informace z jednoho oka
  - Informace z „celého“ zorného pole
- Tractus opticus
  - Informace z obou očí
  - Informace z poloviny zorného pole



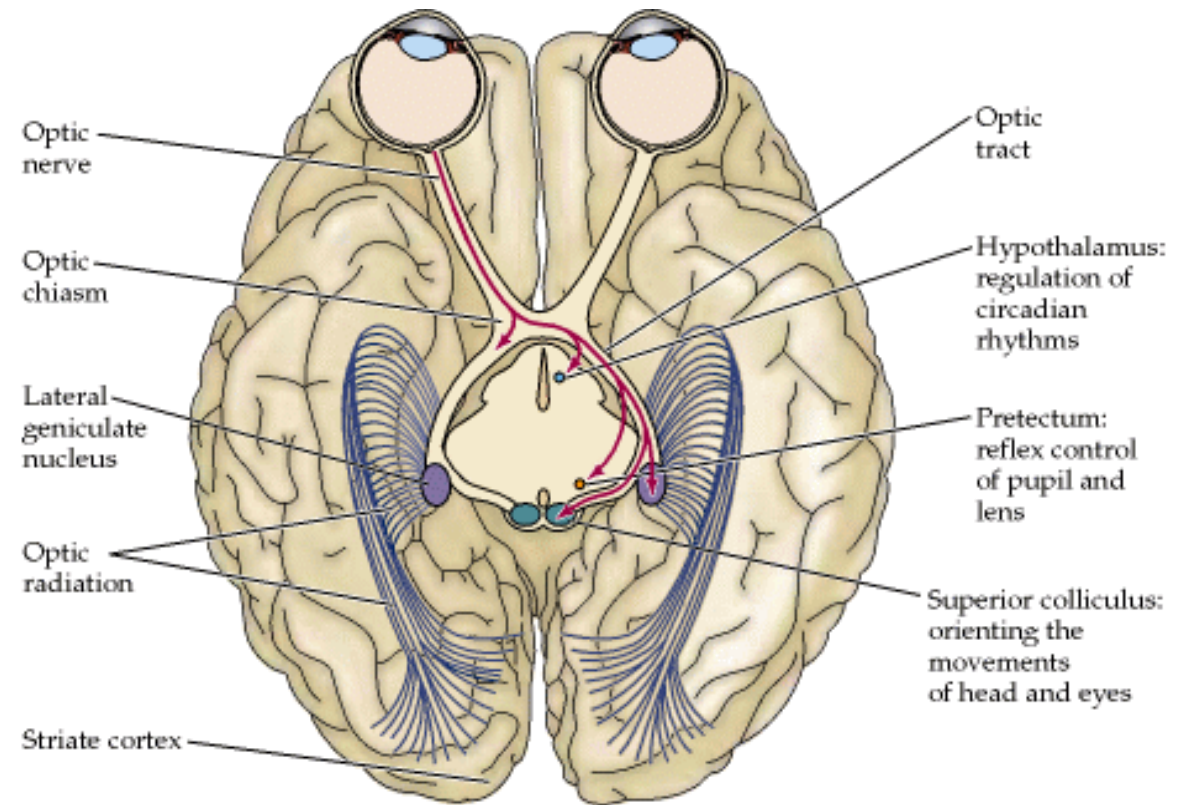
<https://www.aafp.org/afp/2013/0901/p319.pdf>

Copyright © 2008, 2004, 1998, 1993, 1988, 1983 by Mosby, Inc., an affiliate of Elsevier Inc.

<http://www.slideshare.net/CsillaEgri/presentations>

# Zraková dráha

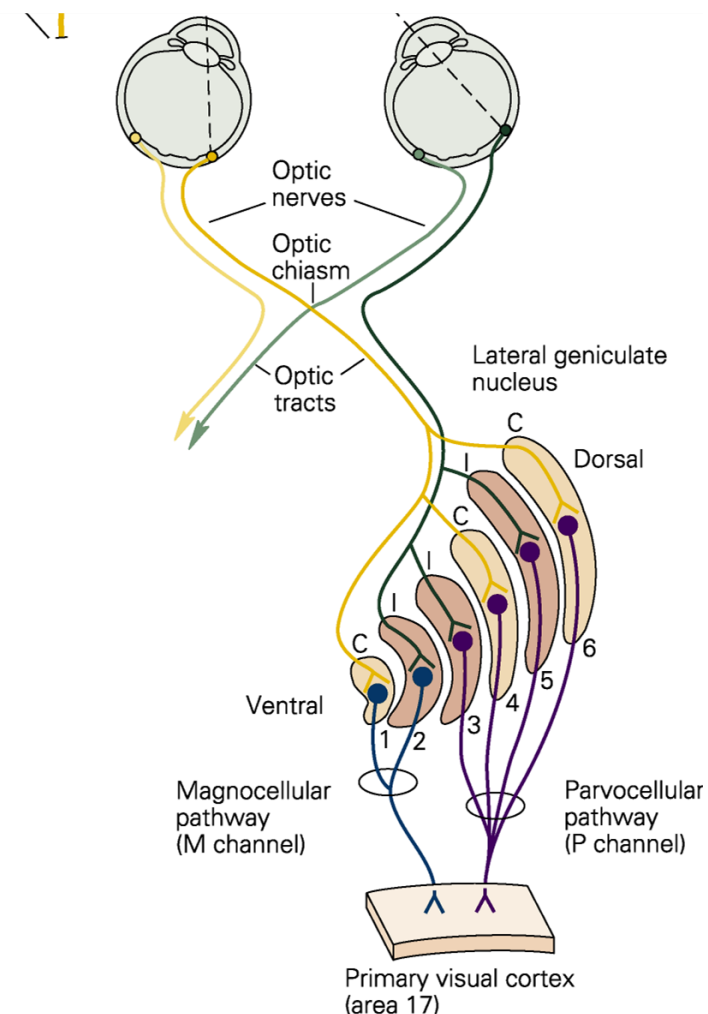
- Nucleus corporis geniculati lateralis
  - Thalamus
  - Většina signálu
  - Dále cestou radiation optica do neokortexu
- Hypothalamus
  - Regulace cirkadiální aktivity
- Pretectum
  - Pupilární reflex
- Colliculi superiores
  - Reflexní pohyby očí a hlavy



<http://www.slideshare.net/drpsdeb/presentations>

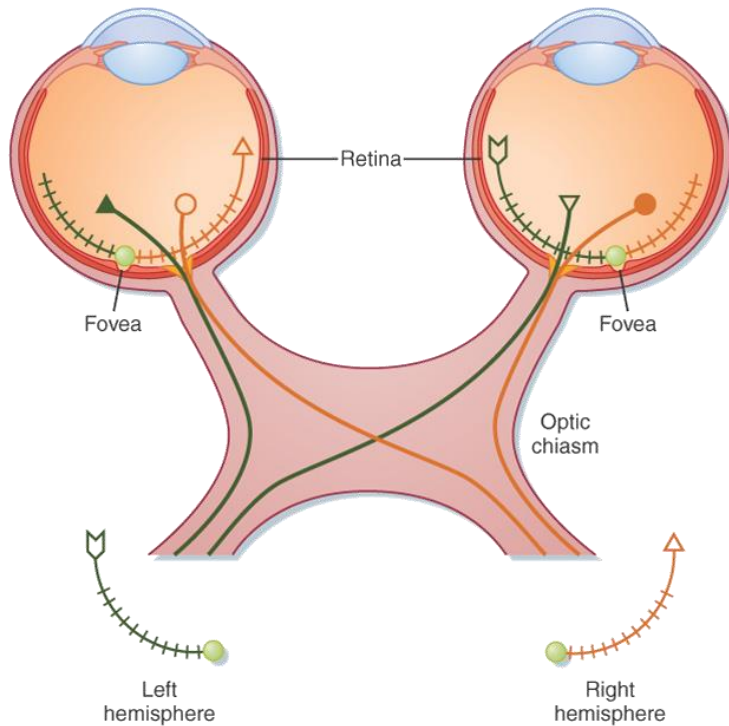
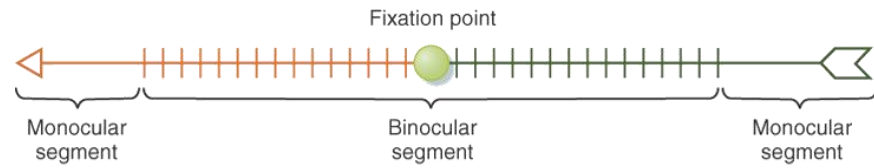
# Nucleus corporis geniculati lateralis

- Šest jaderných vrstev
- Retinotopická organizace
- Každá vrstva dostává informace pouze z jednoho oka
- Vrstva 1-2
  - Magnocelulární systém
    - M gangliové buňky
    - Velká receptivní pole / reakce na jas
  - Informace o lokalizaci a pohyby
- Vrstva 3-6
  - Parvocelulární systém
    - P gangliové buňky
    - Malá receptivní pole / reakce na barvu
  - Informace o tvaru a barvě

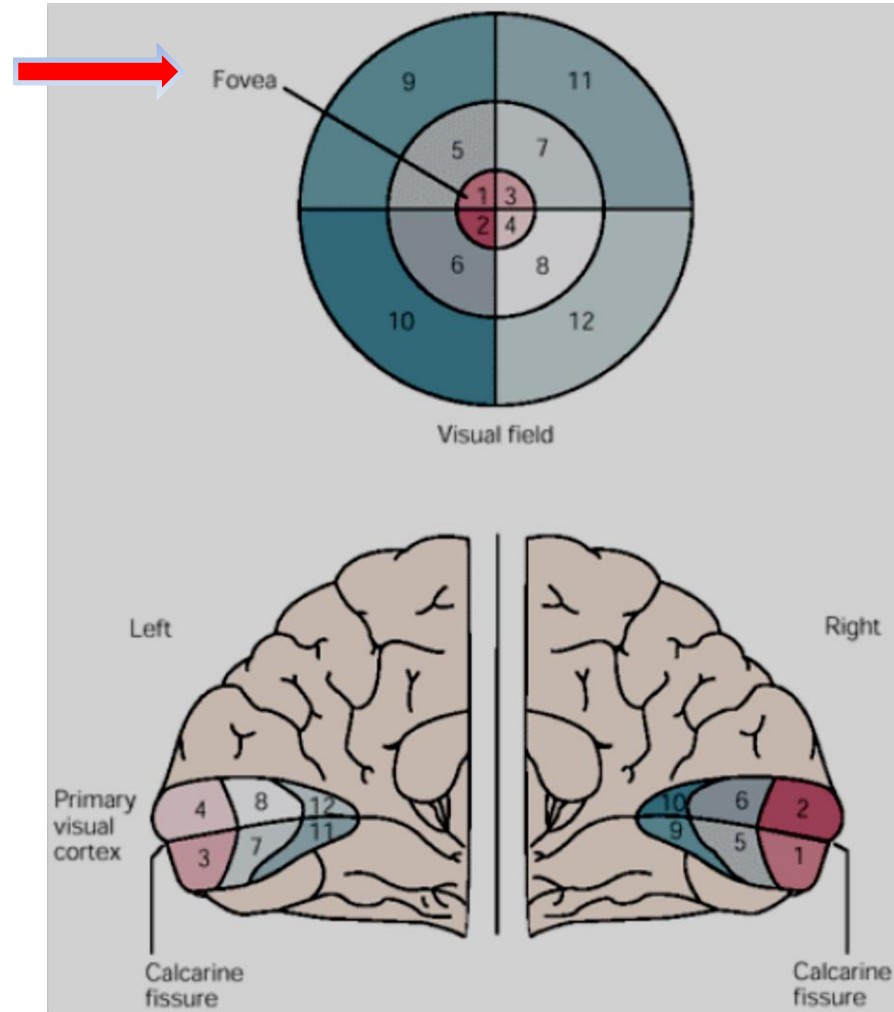


# Primární zrakový kortex

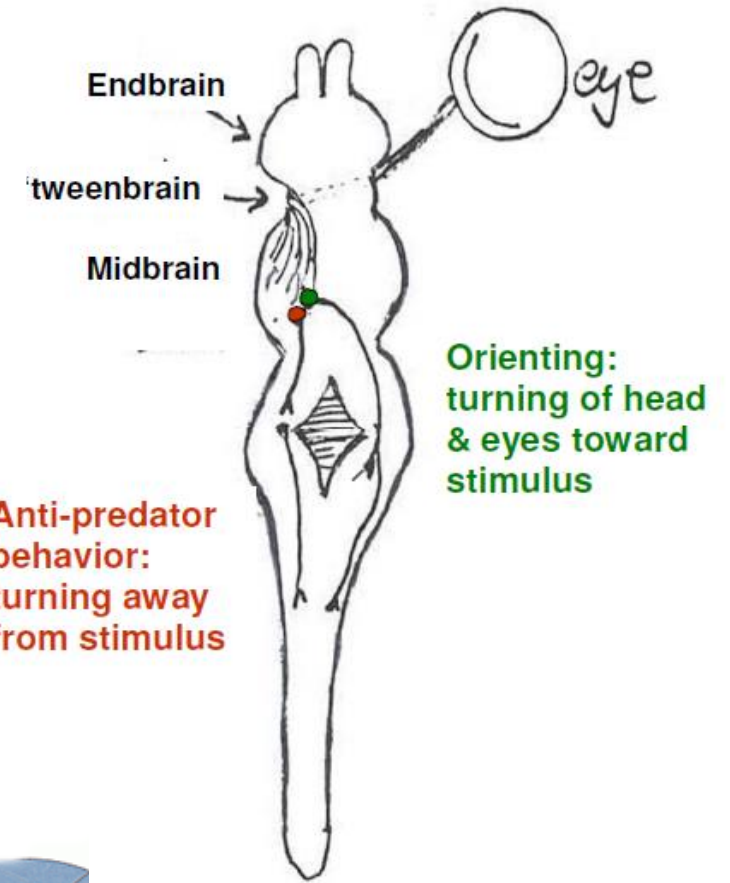
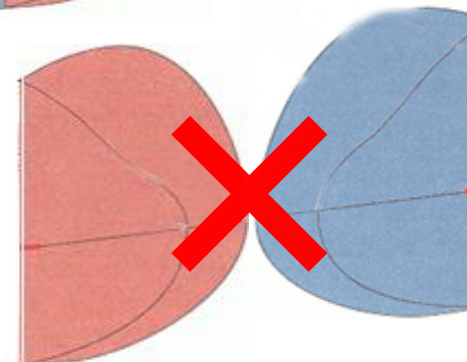
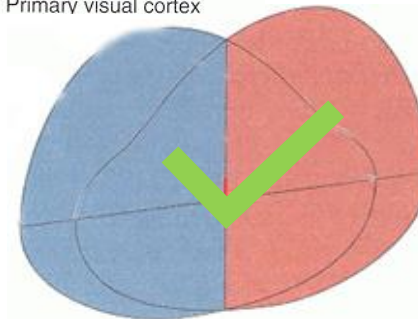
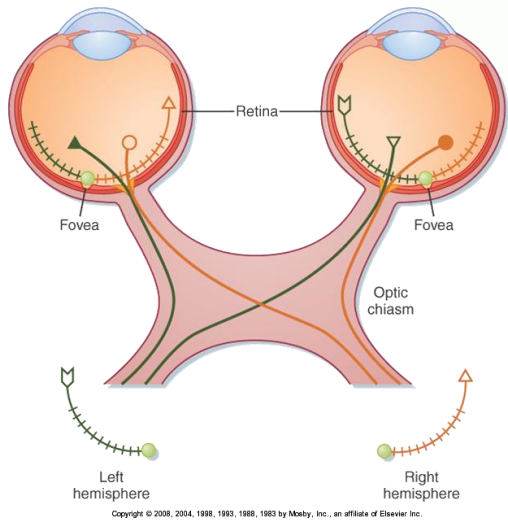
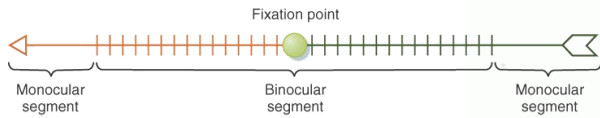
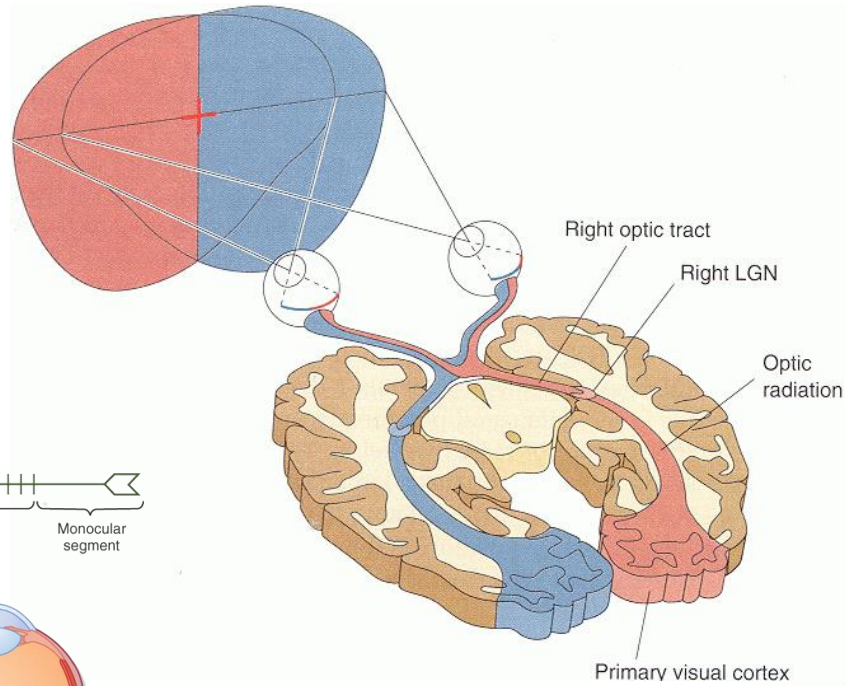
## Retinotopická organizace



Copyright © 2008, 2004, 1998, 1993, 1988, 1983 by Mosby, Inc., an affiliate of Elsevier Inc.



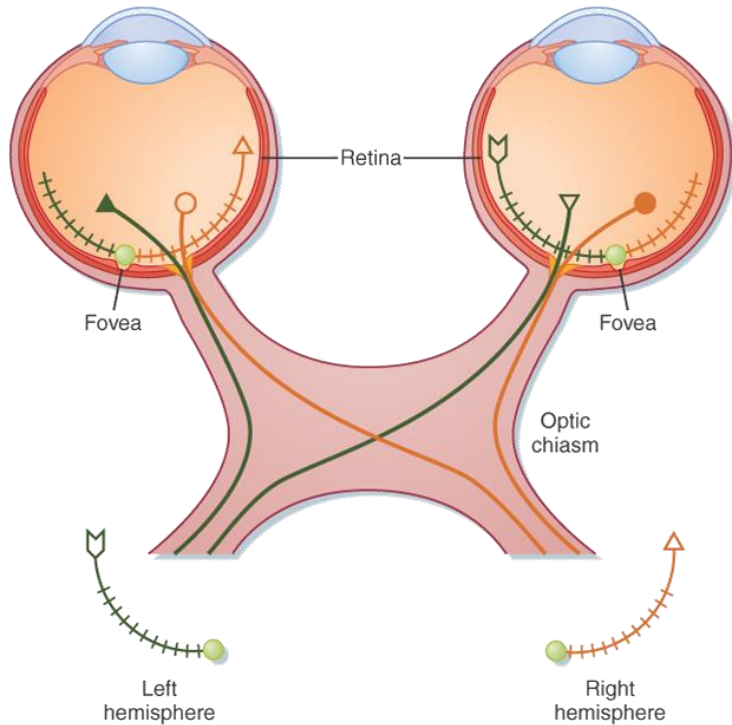
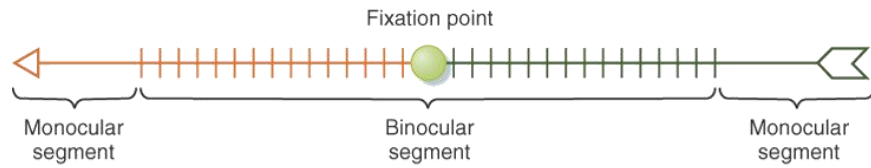




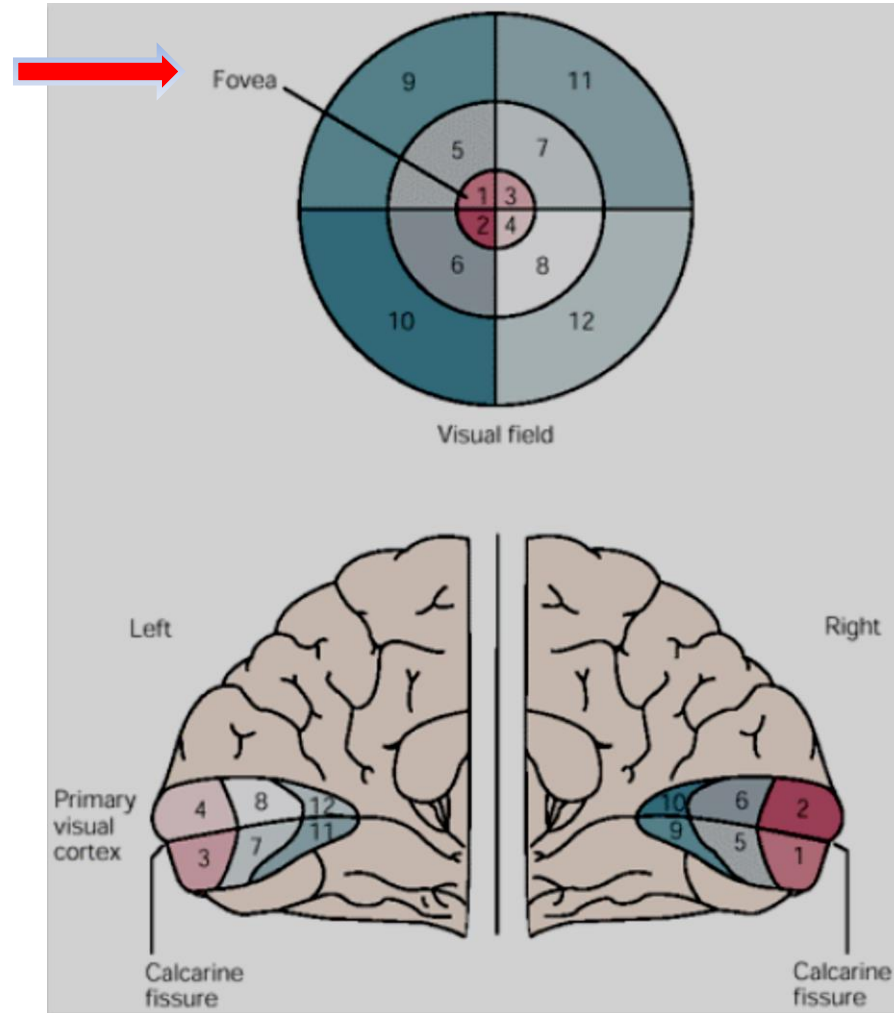
<http://www.slideshare.net/CsillaEgri/presentations>

# Primary visual cortex

## Retinotopic organization

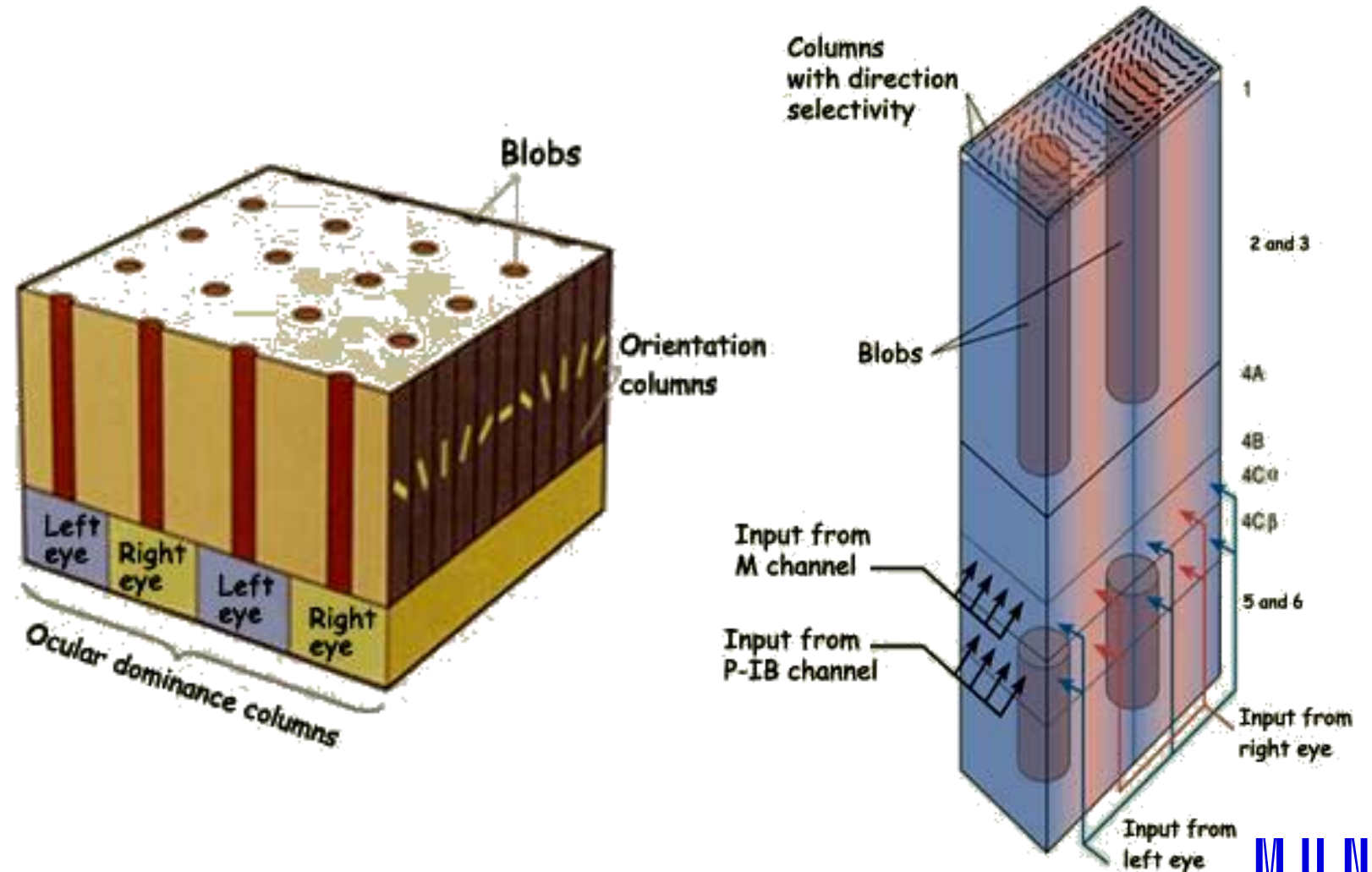


Copyright © 2008, 2004, 1998, 1993, 1988, 1983 by Mosby, Inc., an affiliate of Elsevier Inc.



# Primární zrakový kortex

- ✓ Retinotopická organizace
- ✓ Kolumnární organizace
  - Orientační sloupce
    - Odpověď na specifickou orientaci objektu
  - „Blobs“
    - Odpověď na barvu
  - Sloupce oční dominance
    - Informace z pravého nebo levého oka
- ✓ Horizontální spoje

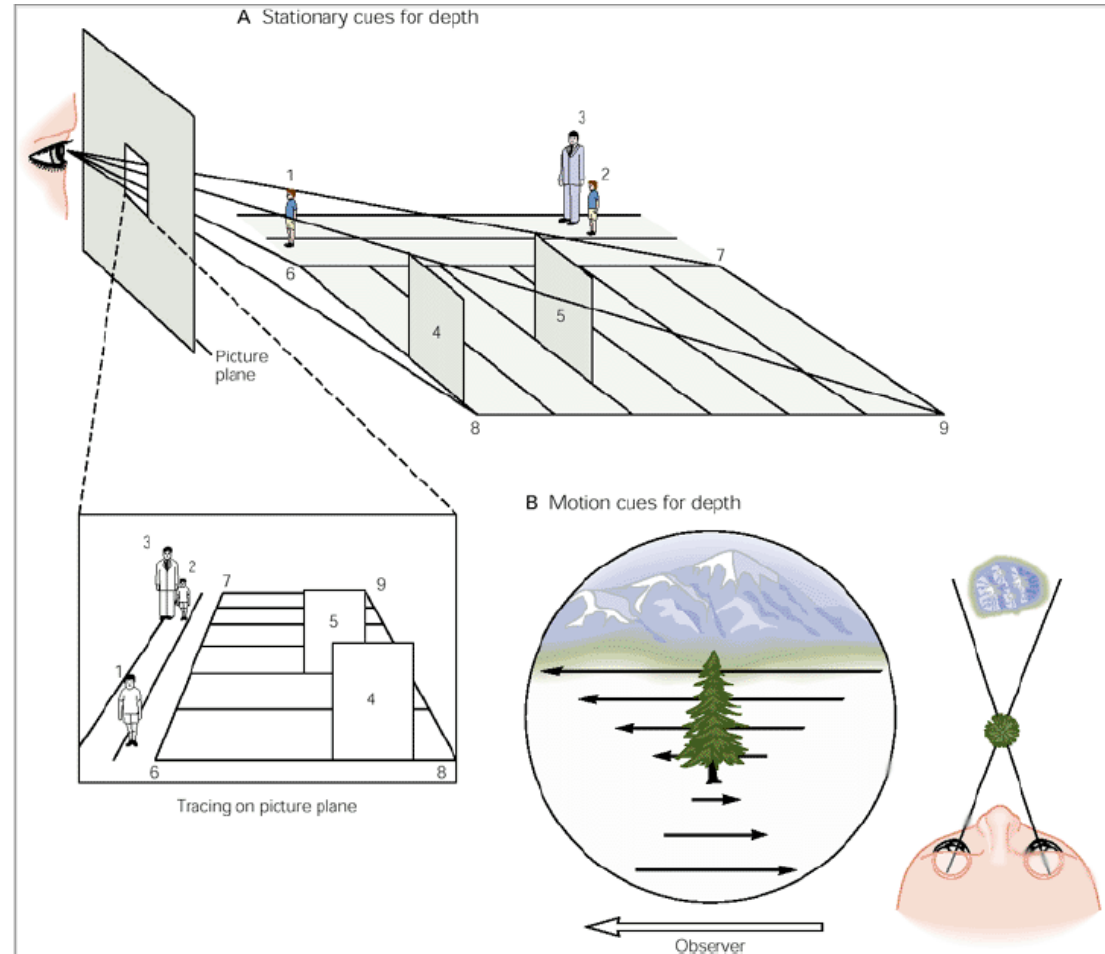
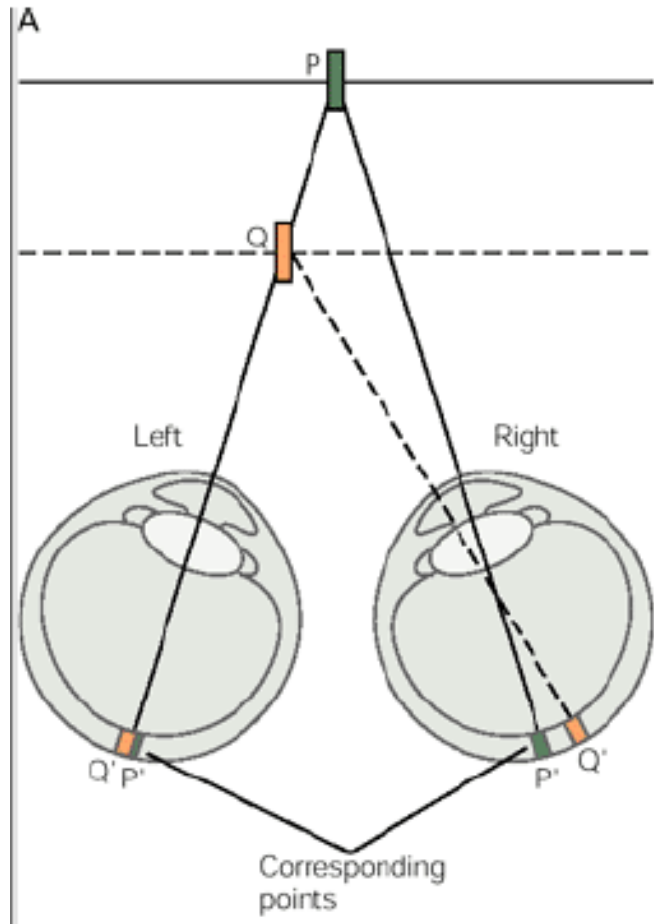




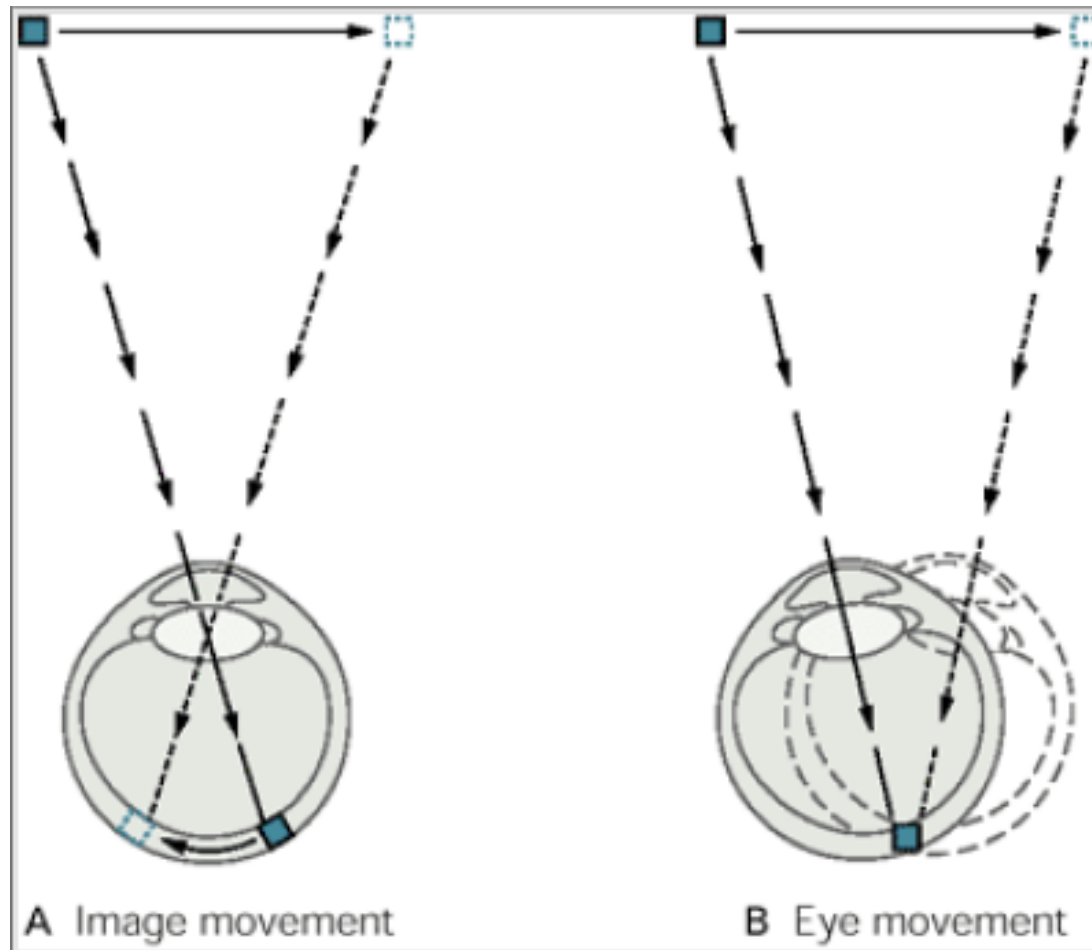
# Prostorové vidění

## Binokulární

## Monokulární – získané zkušenosti

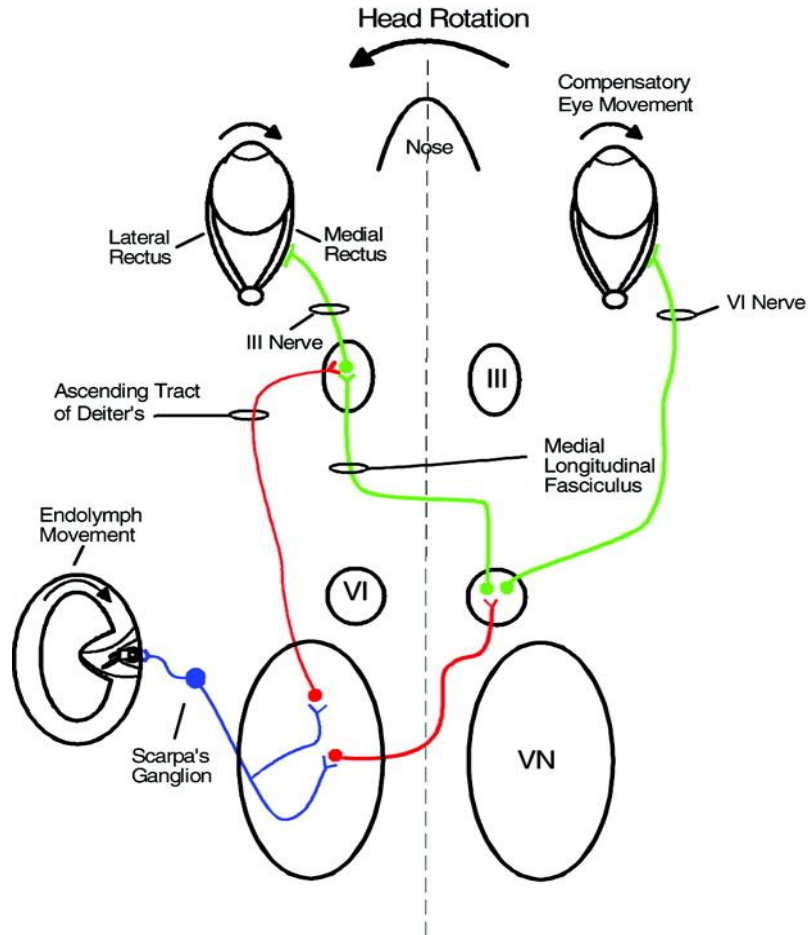


# Pohyb v zorném poli

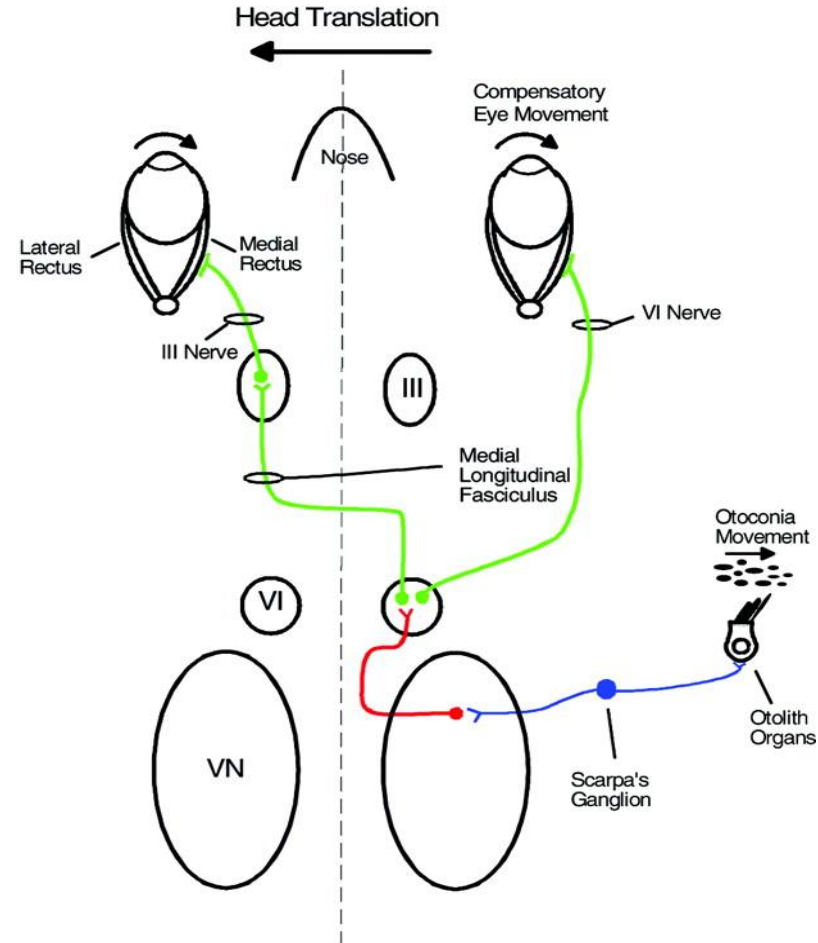


# Vestibulookulární reflex

## Rotational VOR



## Translational VOR




# Nystagmus

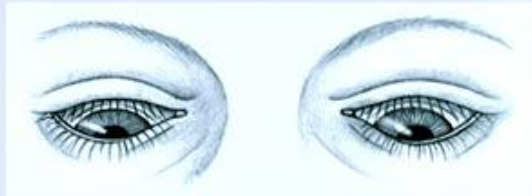
- Nekontrolované rytmické konjugované pohyby očních bulbů
- Fyziologický
  - Postrotační
  - Optokinetický
- Patologický
  - ✓ Periferní
    - Poruchy vestibulárního systému
  - ✓ Centrální
    - Poruchy CNS (cerebellum, medencefalon...)

**Classifying nystagmus**  
The various types of jerk and pendular nystagmus are illustrated below.


**JERK NYSTAGMUS**  
*Convergence-retraction nystagmus* refers to the irregular jerking of the eyes back into the orbit during upward gaze. It can indicate midbrain tegmental damage.



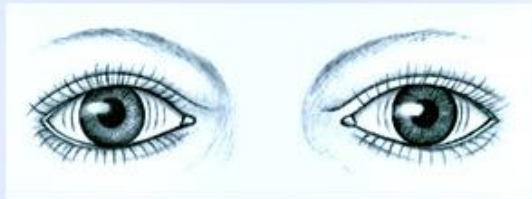
*Downbeat nystagmus* refers to the irregular downward jerking of the eyes during downward gaze. It can signal lower medullary damage.



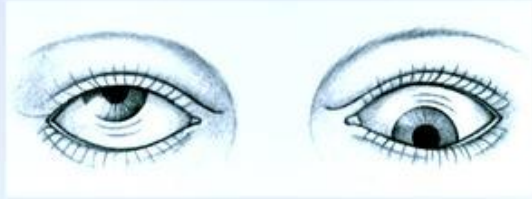
*Vestibular nystagmus*, the horizontal or rotary movement of the eyes, suggests vestibular disease or cochlear dysfunction.



**PENDULAR NYSTAGMUS**  
*Horizontal, or pendular, nystagmus* refers to oscillations of equal velocity around a center point. It can indicate congenital loss of visual acuity or multiple sclerosis.



*Vertical, or seesaw, nystagmus* is the rapid, seesaw movement of the eyes: One eye appears to rise while the other appears to fall. It suggests an optic chiasm lesion.





# Sakadické pohyby

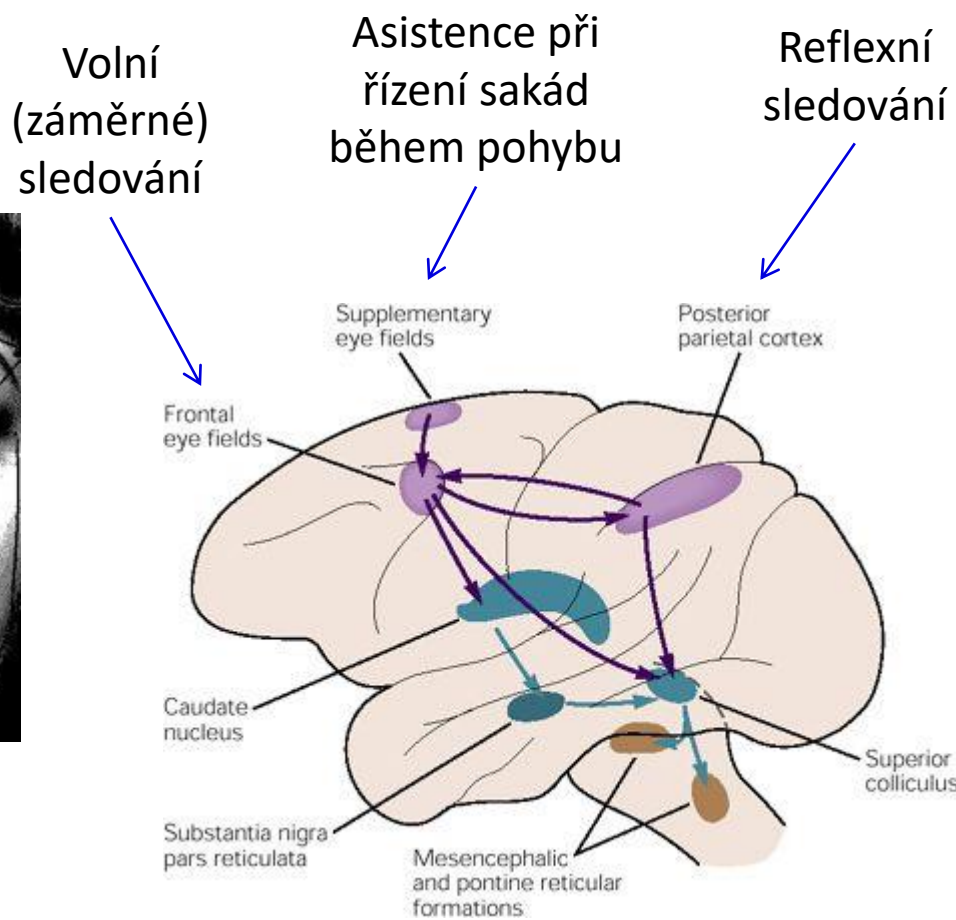


<https://en.wikipedia.org/wiki/Saccade#/media/File:Szakkad.jpg>

# Sakadické pohyby



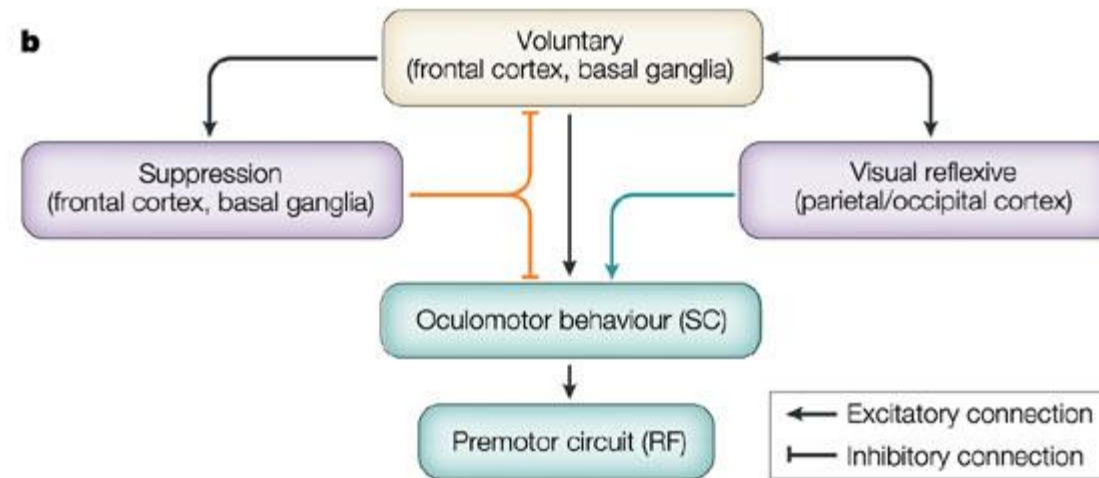
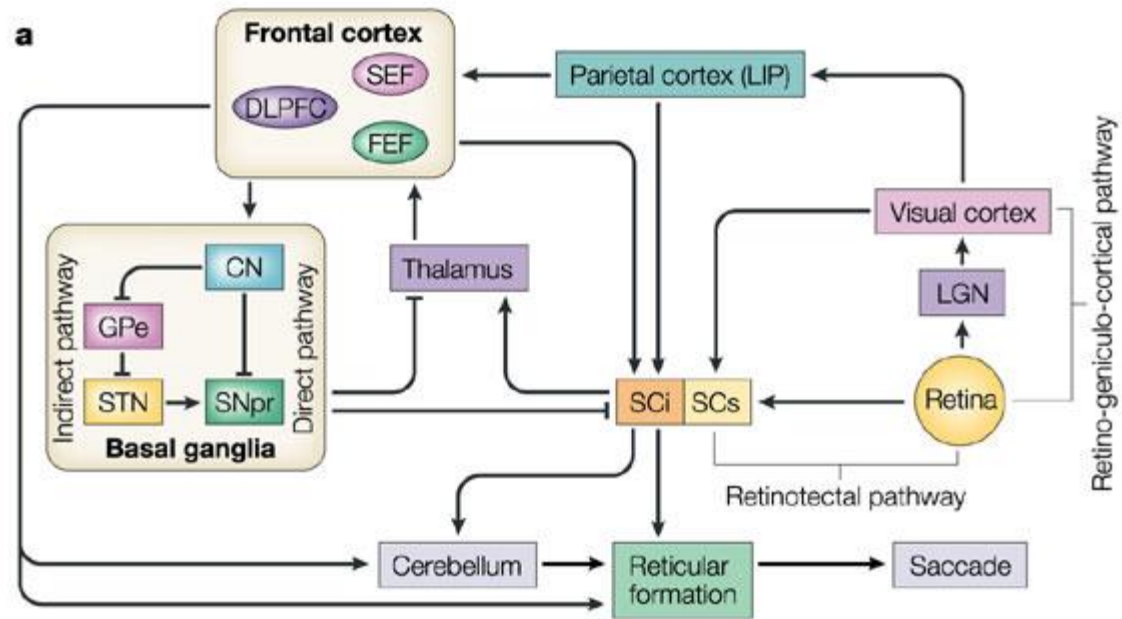
<https://en.wikipedia.org/wiki/Saccade#/media/File:Szakkad.jpg>



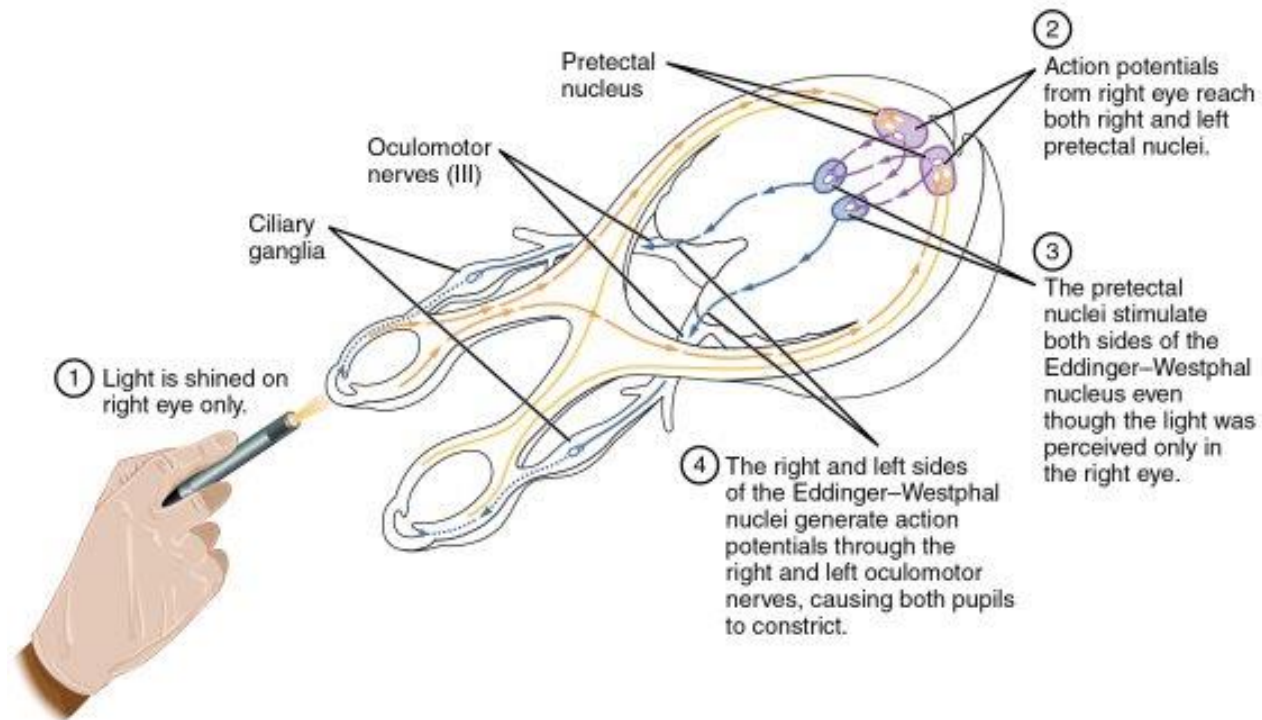
<https://s-media-cache-ak0.pinimg.com/564x/51/f7/26/51f7267e7c8a59caa90f904cd4f965eb.jpg>

**26TH PRAGUE  
INTERNATIONAL  
FILM FESTIVAL  
21.-29.03.2019**





# Pupilární reflex



[http://www.ubooks.pub/Books/B0/E27R7642/MAIN/images/1509\\_Pupillary\\_Reflex\\_Pathways.jpg](http://www.ubooks.pub/Books/B0/E27R7642/MAIN/images/1509_Pupillary_Reflex_Pathways.jpg)

## 78. Základy fyziologie zraku – funkce tyčinek a čípků, on/off receptivní pole, nervus opticus vs. tractus opticus

- Funkce tyčinek a čípků
  - Charakteristika a srovnání
  - Mechanismus fotodransdukce a adaptace
- Stručný přehled organizace sítnice (sítnice zpracovává receptorový potenciál - analogový, akční potenciál je generován v gangliových buňkách)
- Organizace receptivního pole
  - On/off receptivní pole
  - Magnocelulární systém (ČB)
  - Parvocelulární systém (Barva)
- Nervus opticus vs. tractus opticus
- Projekce z tractus opticus (hlavní mozková centra zapojena do zpracování zrakové informace)

M U N I

M E D