

# Augenmuskulatur und Augenbewegungen. Konjugierte Augenbewegungen, Strabismus. Neuroanatomische Grundlagen des plastischen Sehens.

Dr. Szabó Arnold

[szabo.arnold@med.semmelweis-univ.hu](mailto:szabo.arnold@med.semmelweis-univ.hu)

Semmelweis Universität

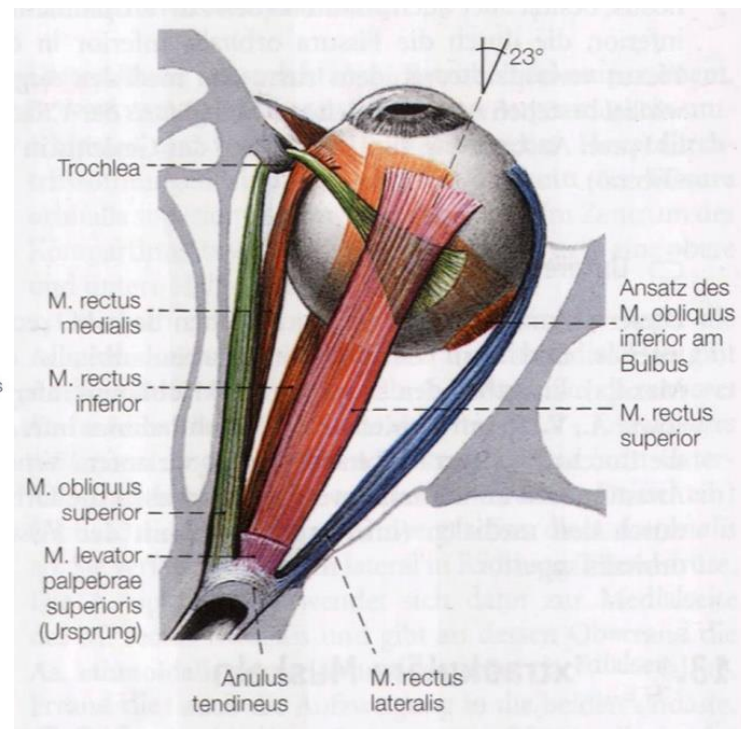
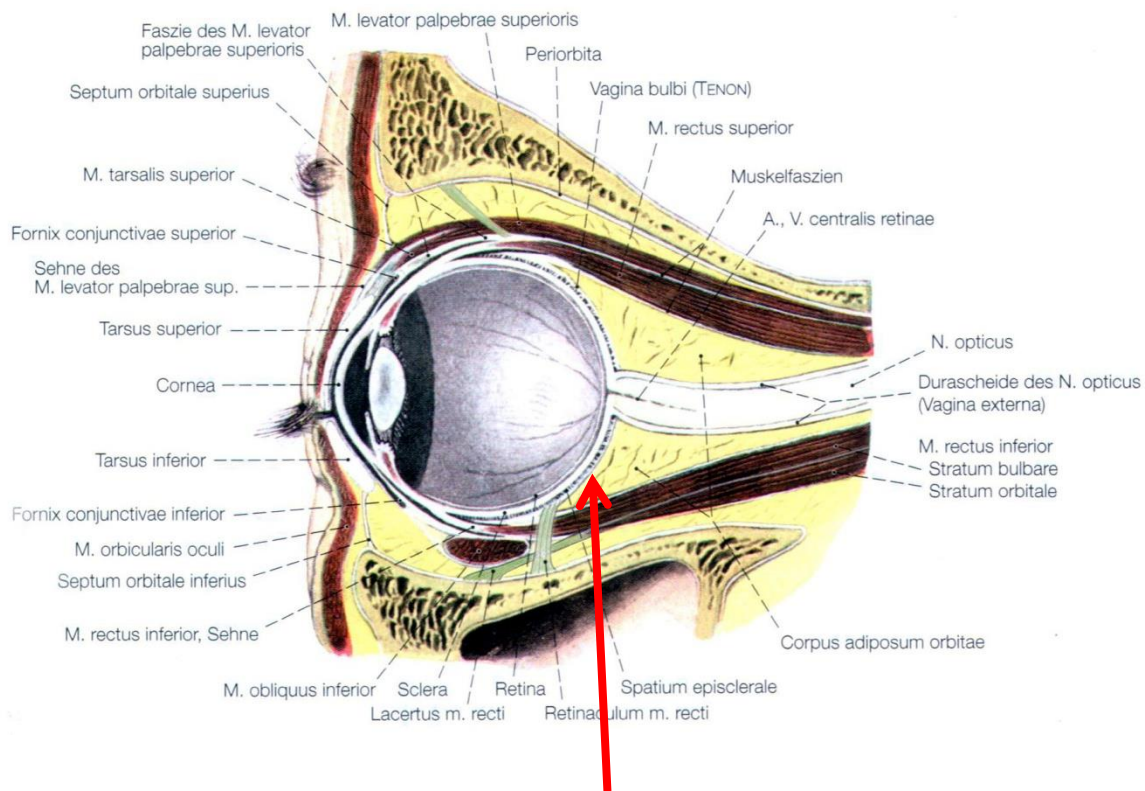
Anatomisches, Histologisches und Embryologisches Institut

15. November 2017



**Jacques-René Tenon**  
(1724 -1816)

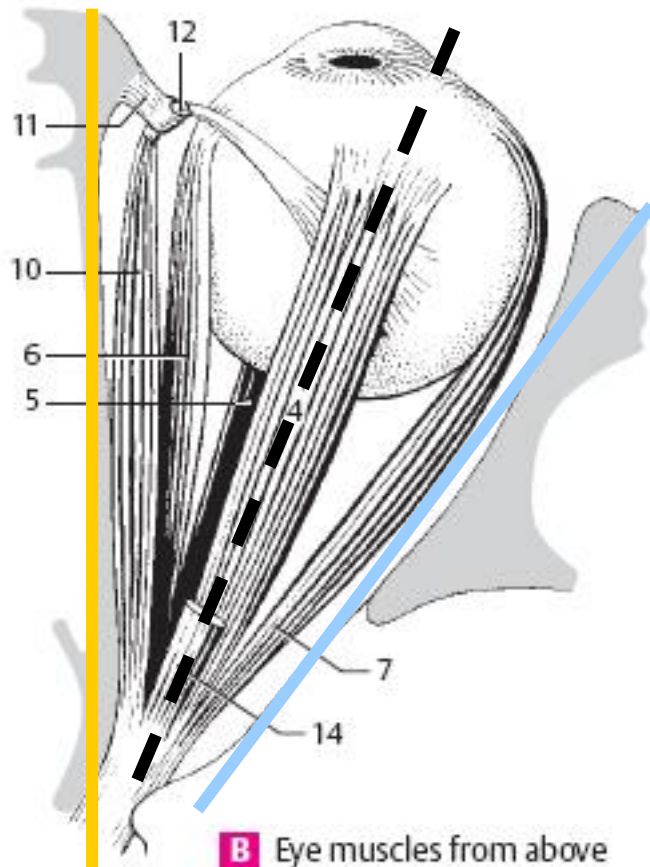
# Musculi bulbi externi



**Vagina bulbi (Tenon-Kapsel)**

# Anatomie der Orbita: Axen

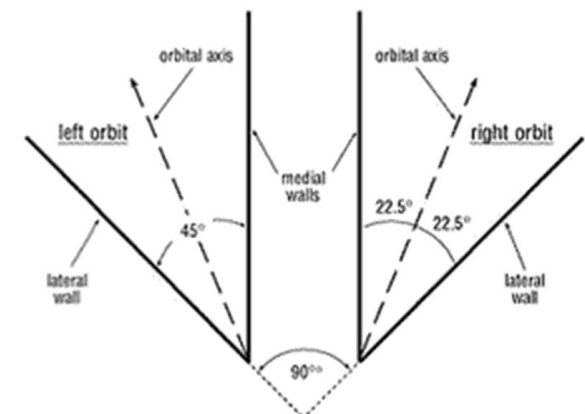
## Axe der Orbita



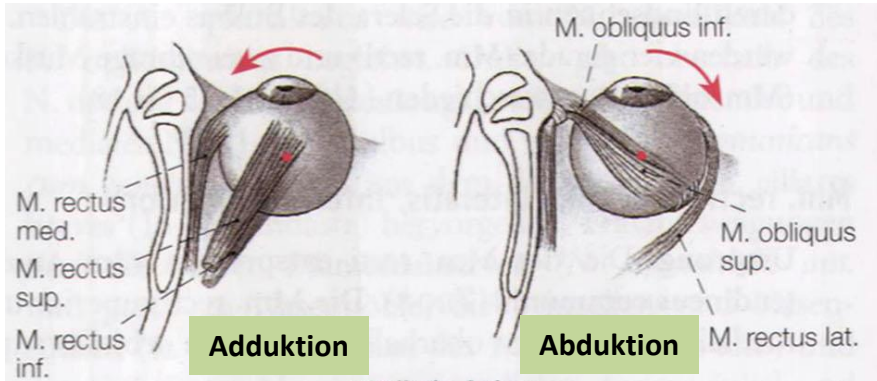
Die mediale Orbitawand zieht sagittal

Die laterale Orbita weicht von der Sagittalebene  $45^\circ$  nach lateral ab

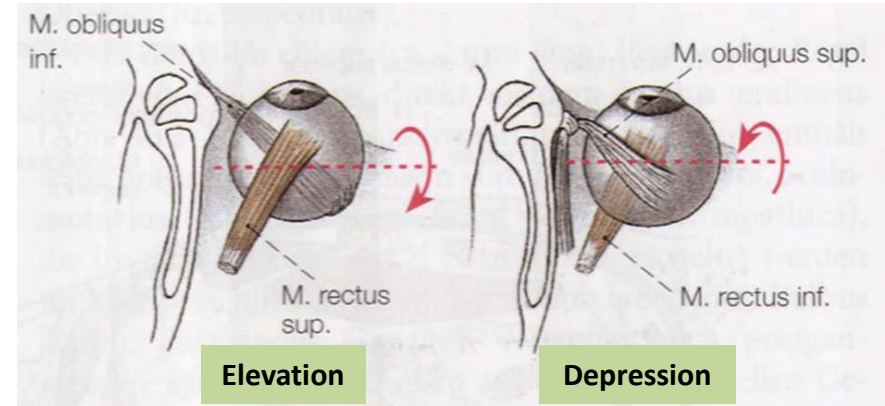
Die anteroposteriore Axe des Auges zieht sagittal



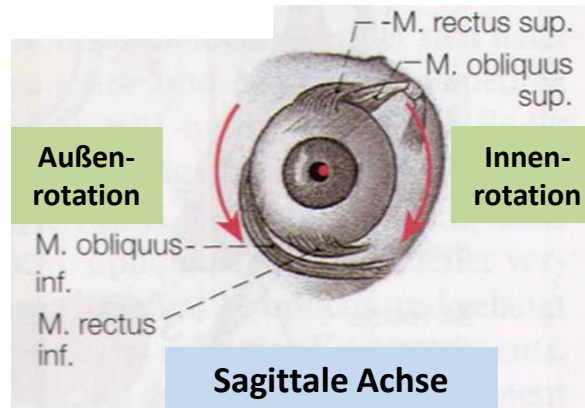
# Augenbewegungen



**Verticale Achse**

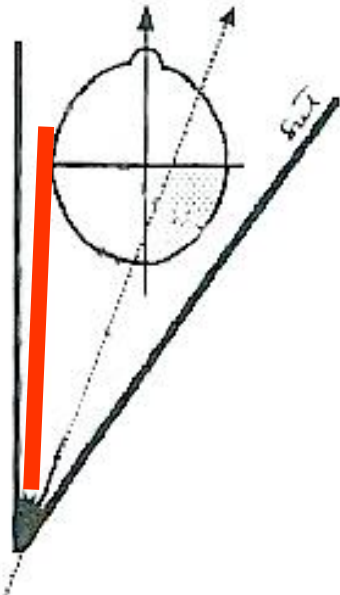


**Transversale Achse**



**Sagittale Achse**

# Musculus rectus medialis

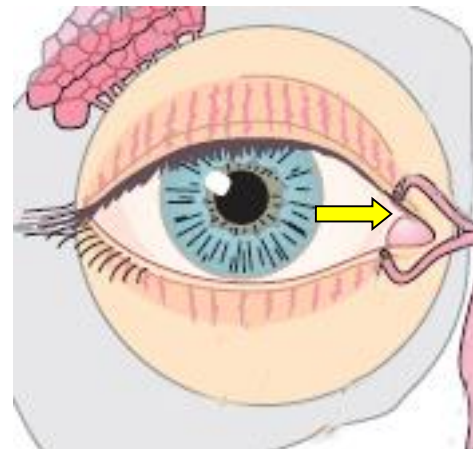
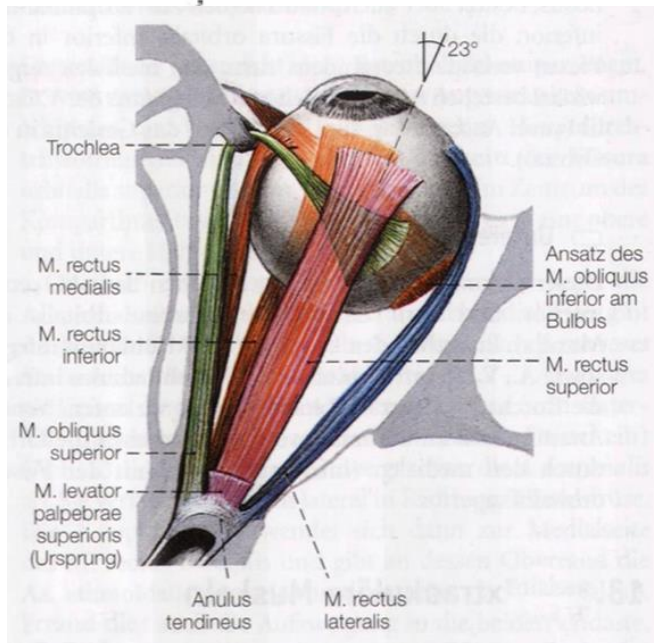


Vertikale Axe: Adduktion

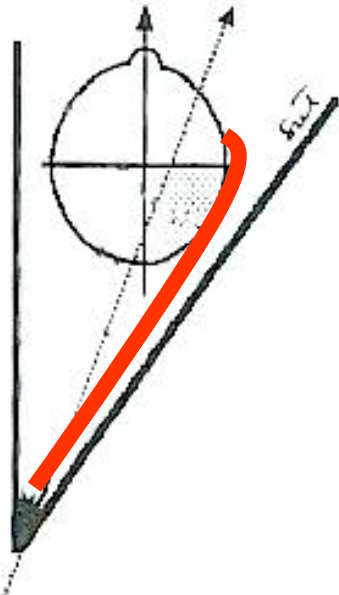
Transversale Axe: -

Sagittale Axe: -

Innervation: N. III.



# Musculus rectus lateralis

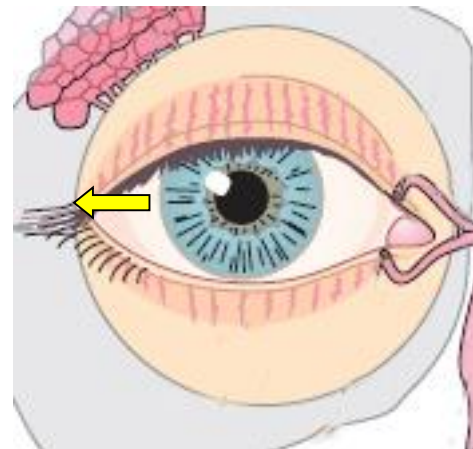
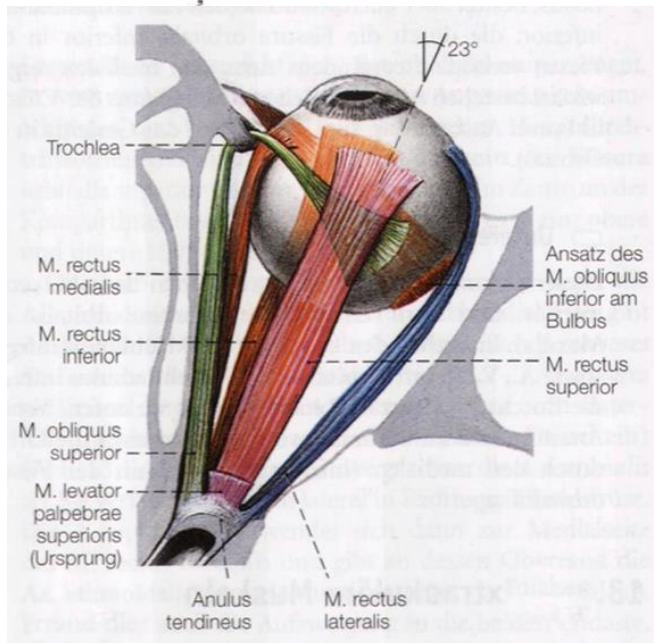


Vertikale Axe: Abduktion

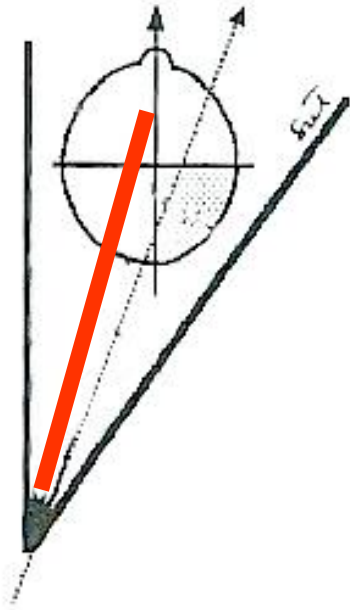
Transversale Axe : -

Sagittale Axe: -

Innervation: N. VI.



# Musculus rectus superior



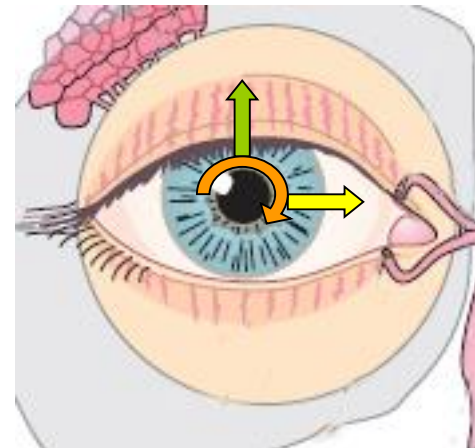
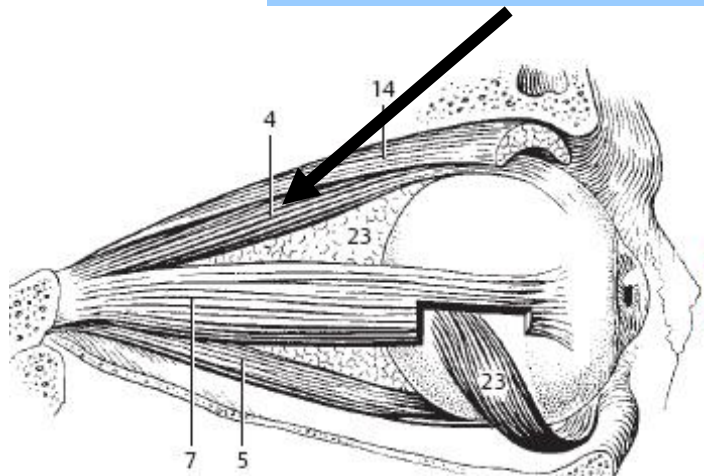
Vertikale Axe: Adduktion

Transversale Axe: Elevation

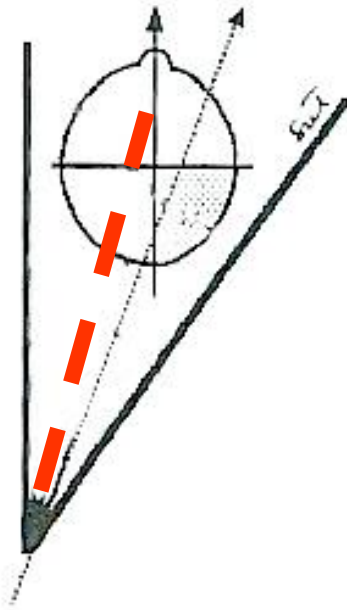
Sagittale Axe: Innenrotation

Innervation: N. III.

M. rectus superior



# Musculus rectus inferior



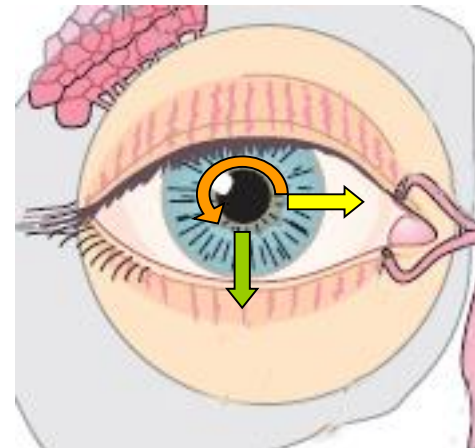
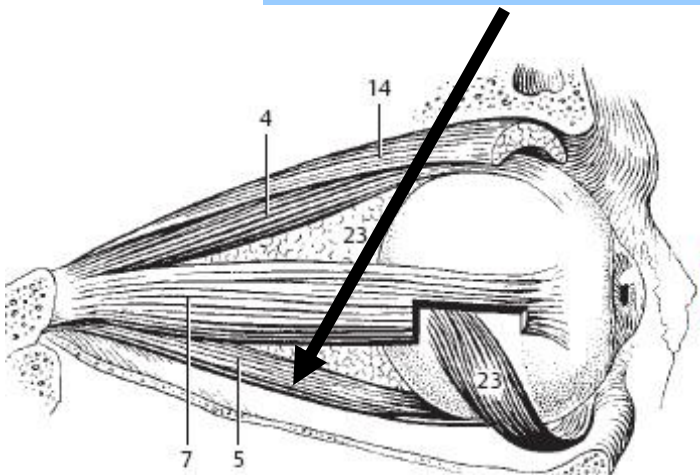
Vertikale Axe: Adduktion

Transversale Axe : Depression

Sagittale Axe: Außenrotation

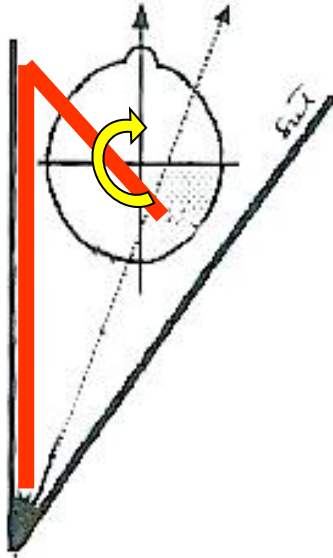
Beidegzés: N. III.

M. rectus inferior





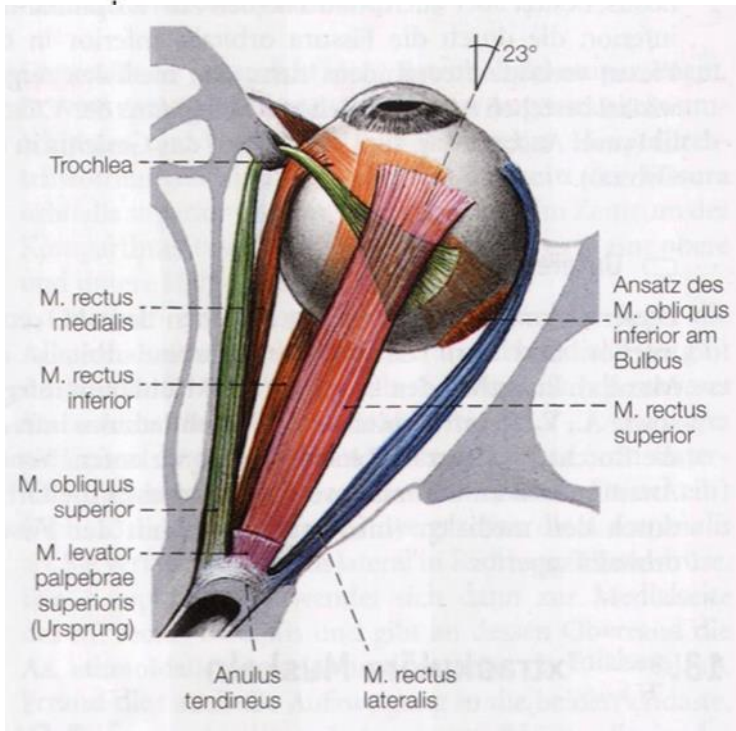
# Musculus obliquus superior



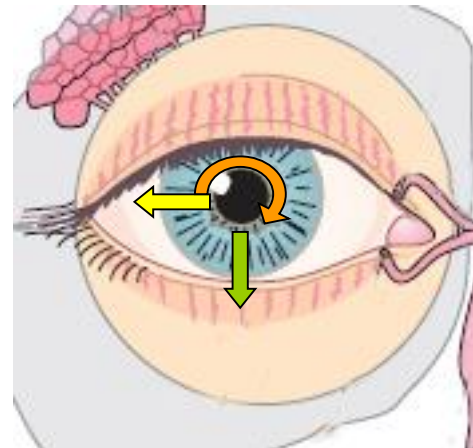
Vertikale Axe : Abduktion

Transversale Axe : Depression

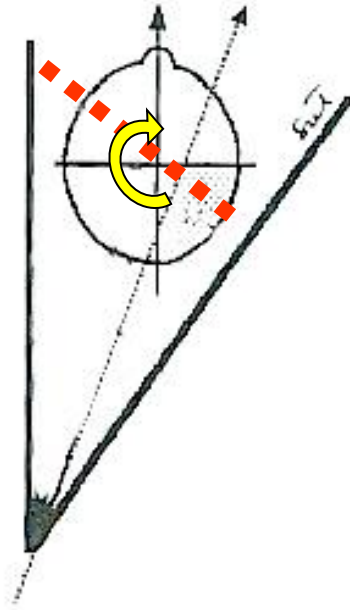
Sagittale Axe: Innenrotation



Innervation: N. IV.



# Musculus obliquus inferior

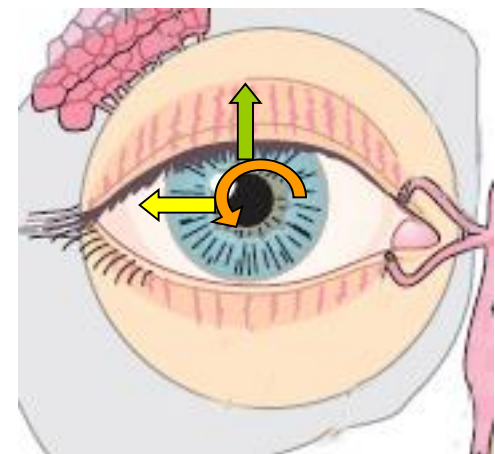
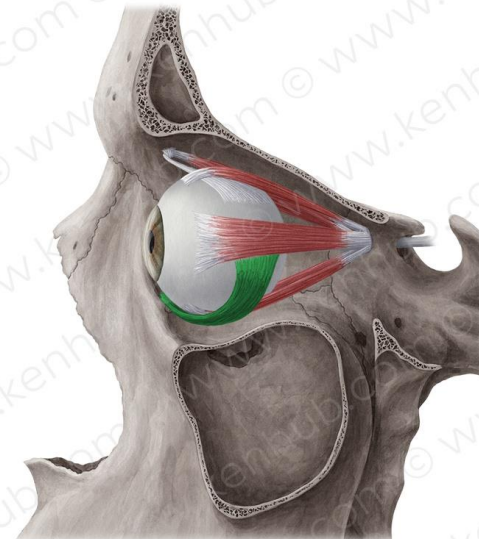
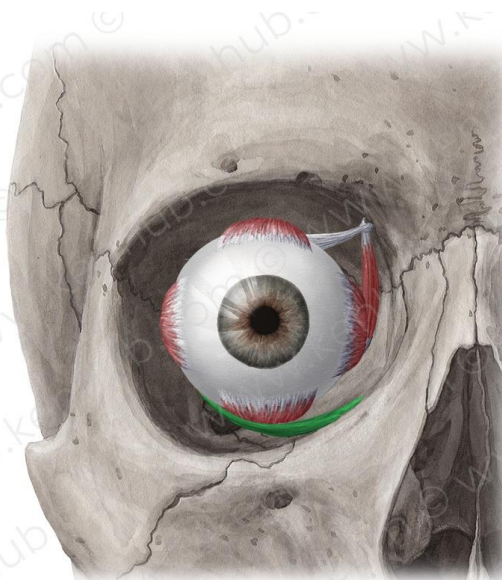


Vertikale Axe : Abduktion

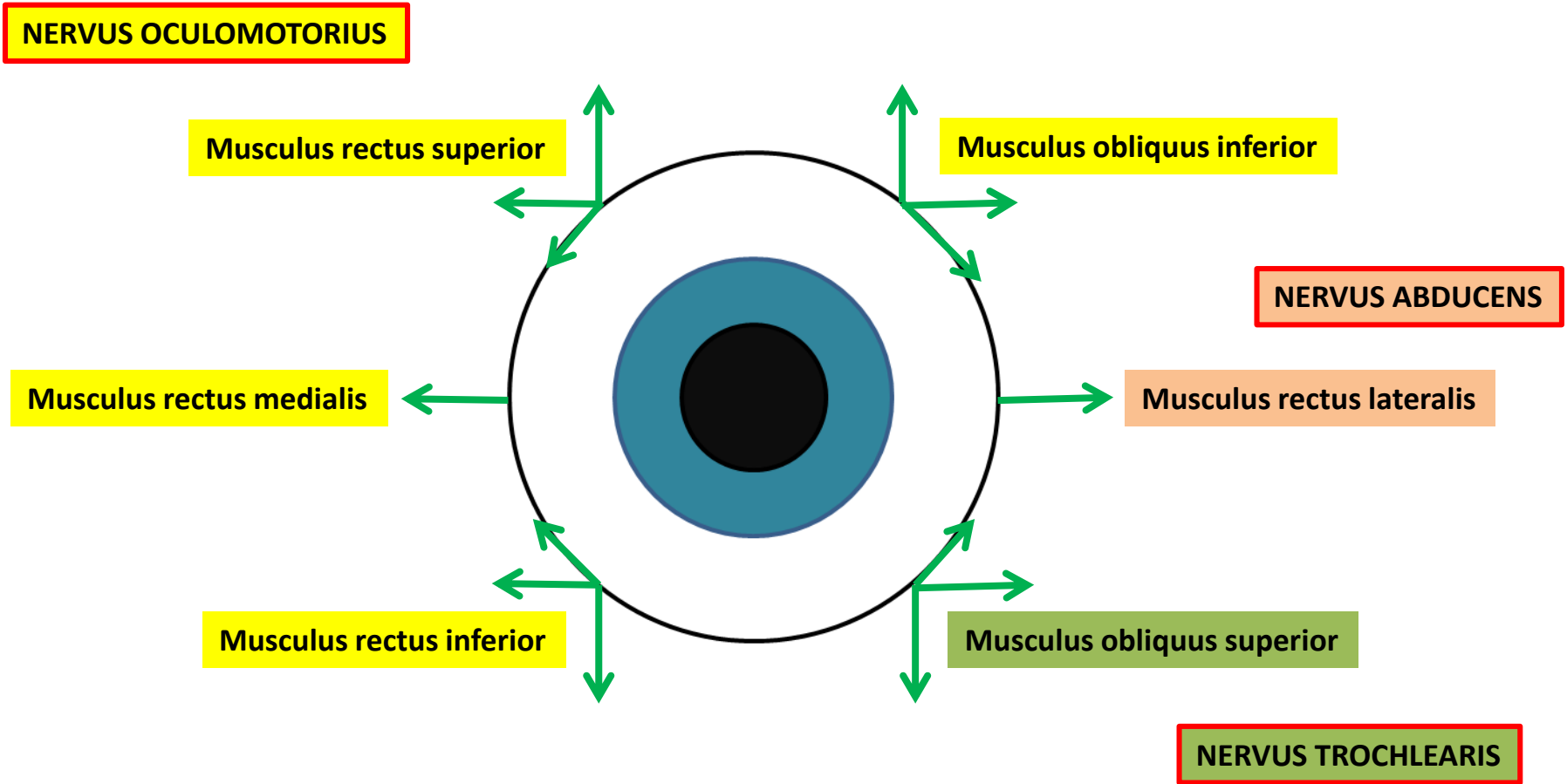
Transversale Axe: Elevation

Sagittale Axe: Außenrotation

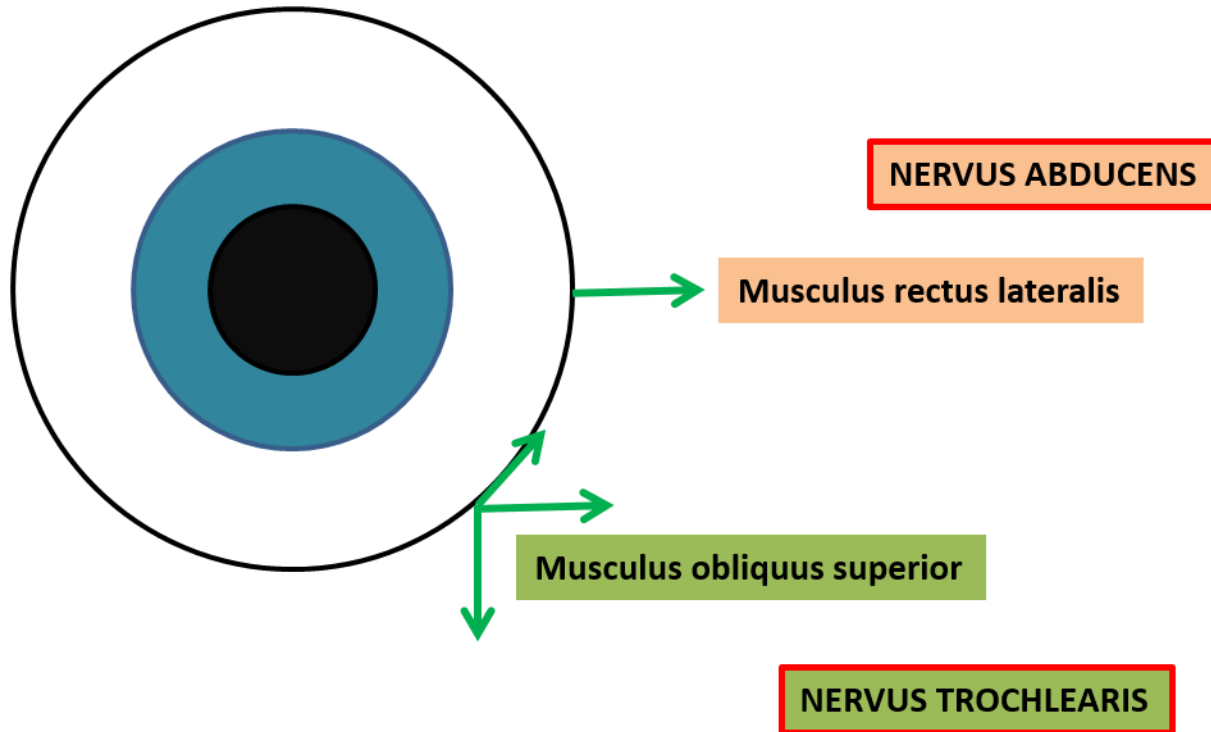
Innervation: N. III.



# Schema der Augenbewegungen



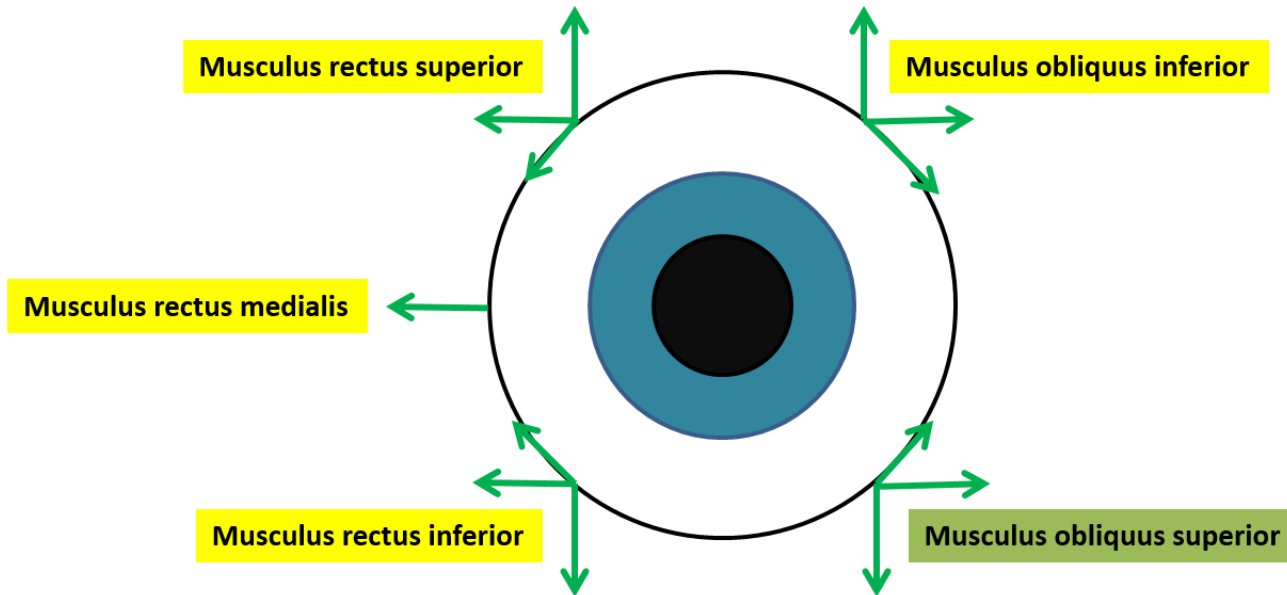
# Lähmung des Nervus oculomotorius



- + **Akkomodationsfehler** (M. ciliaris)
- + **Ptosis** (M. levator palpebrae sup.)
- + **Mydriasis** (M. sphingter pupillae)

# Lähmung des Nervus abducens

**NERVUS OCULOMOTORIUS**



**NERVUS TROCHLEARIS**

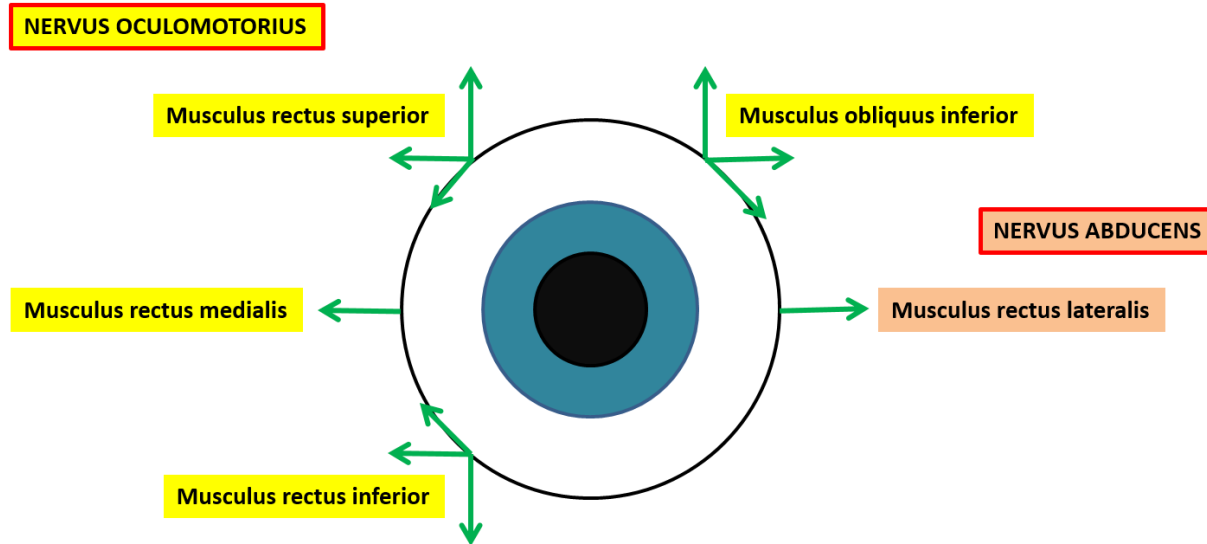


Der Blick in die Richtung der unbetreffenen Seite ist ungestört.



Beim Blick auf die betroffene Seite fällt die Abduktion des befallenen Auges weg.

# Lähmung des Nervus trochlearis

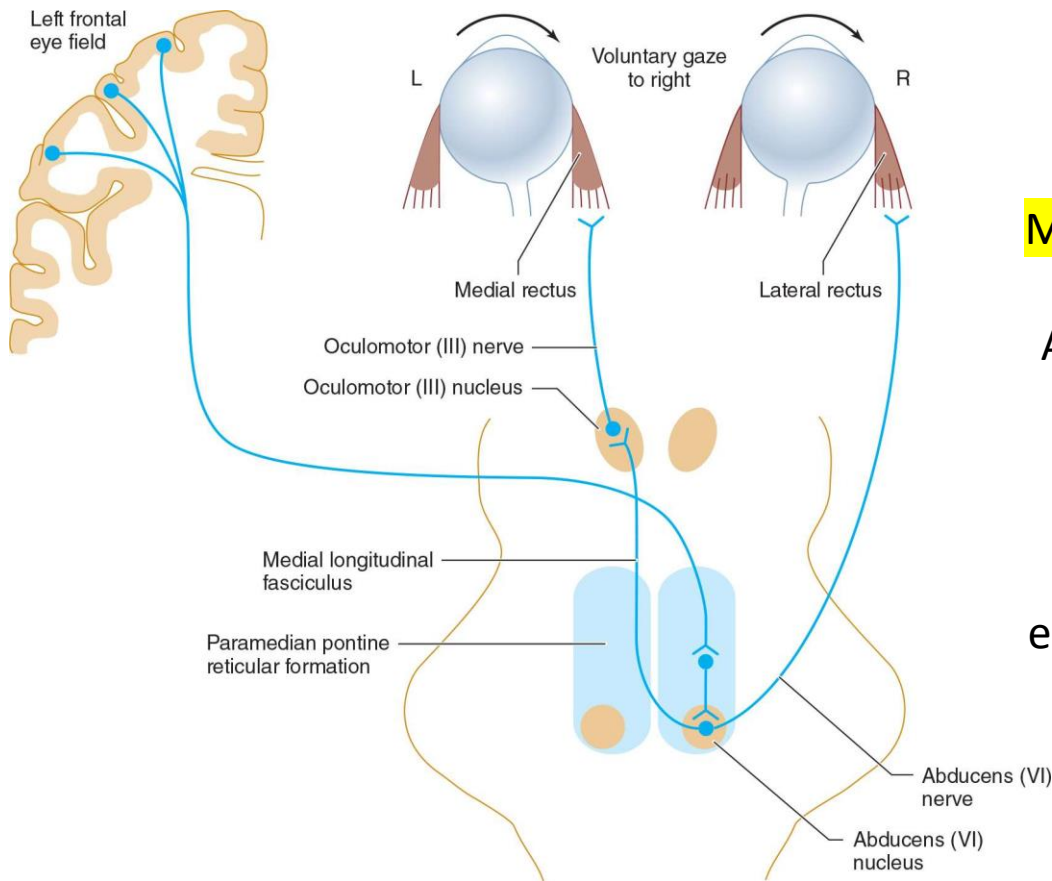


Wegen der fehlenden Innenrotation des M. obliquus superior neigt der Kranke seinen Kopf auf die gesunde Seite.  
„Der Hals tut mir weh.“



Beim Neigen des Kopfes auf die betroffene Seite schwebt das befallene Auge leicht nach oben.

# Konjugierte horizontale Augenbewegungen



Frontales Blickzentrum (Brodmann 8)



Kontralaterales Blickzentrum in der Brücke (paramediane pontine Formatio Reticularis)



Kontralaterale Nucleus nervi abducentis



Kontralateraler M. rectus lateralis

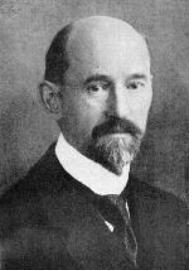


Axone der sog. *internukleären Neurone* des Nucleus nervi abducentis steigen im **Fasciculus longitudinalis medialis** auf und kreuzen die Seite (sie kehren zu der Seite des Frontales Blickzentrums zurück) und erregen die Motoneuronen des **ipsilateralen Nucleus motorius nervi III.**, die den **Musculus rectus medialis** versorgen

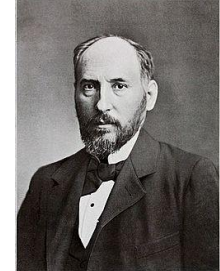


**Ipsilateraler M. rectus medialis**

Folge: Blick zu der Gegenseite

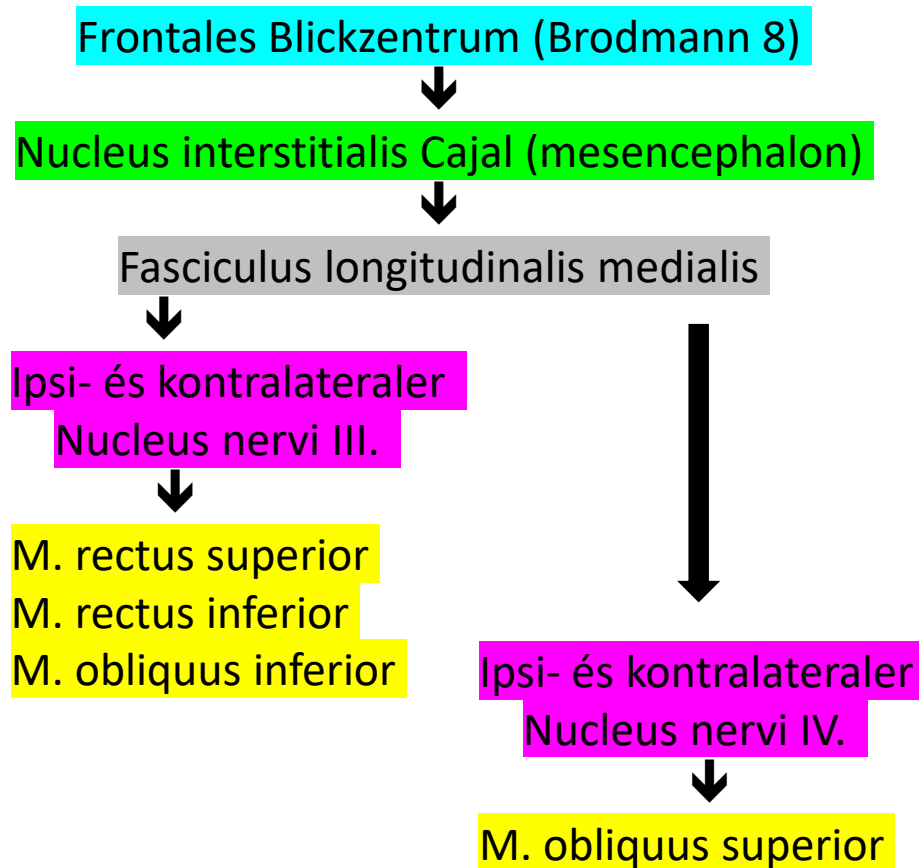


Korbinian Brodmann  
(1868 – 1918)



Santiago Ramon y Cajal  
(1852 – 1934)

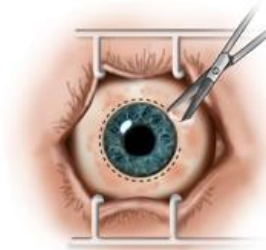
# Konjugierte vertikale Augenbewegungen





# Enucleation of the right eye

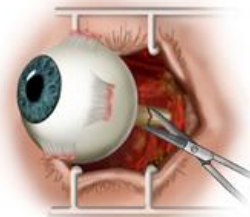
A. The conjunctiva is opened with blunt scissors.



B. The four rectus muscles are removed from their attachments to the eye.



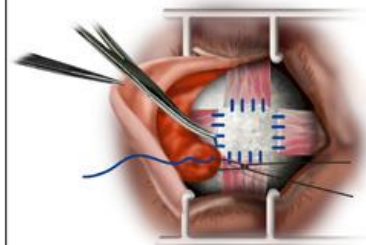
C. The eyeball is rotated partially out of the socket allowing for the optic nerve and the oblique muscles to be cut.



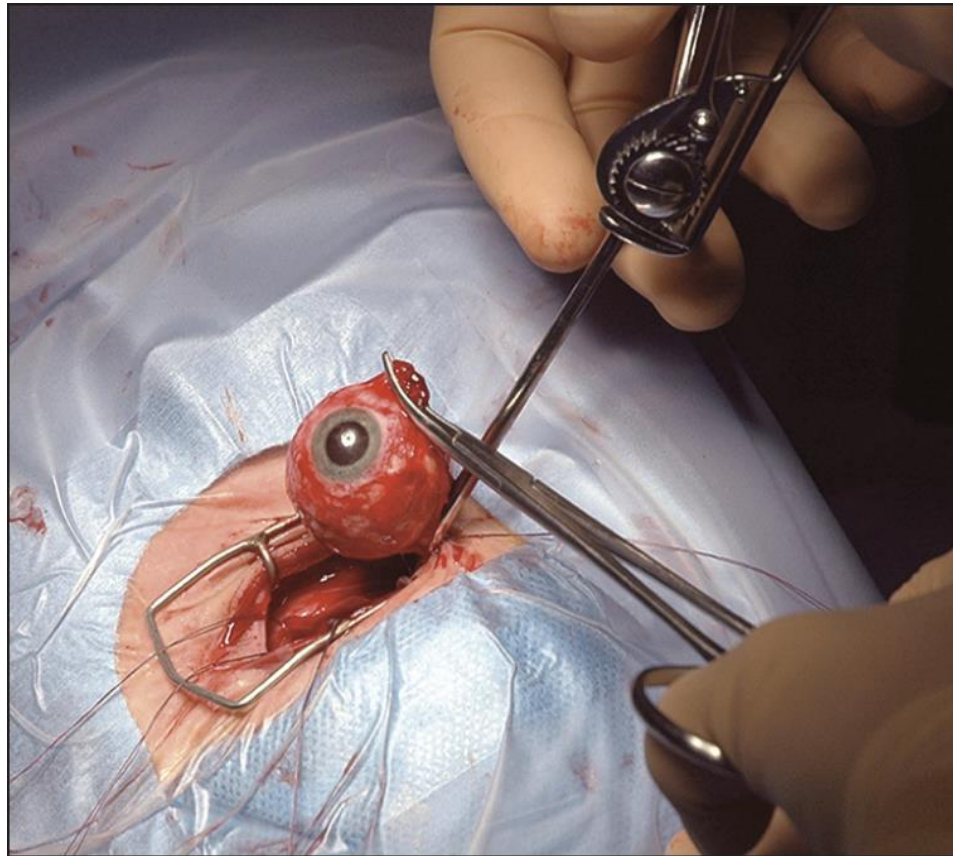
D. After the eye is removed, a synthetic globe is placed into the empty socket. The remaining muscle stumps are then attached to the synthetic globe which has been wrapped in sclera (protective eye covering) from a donor eye.



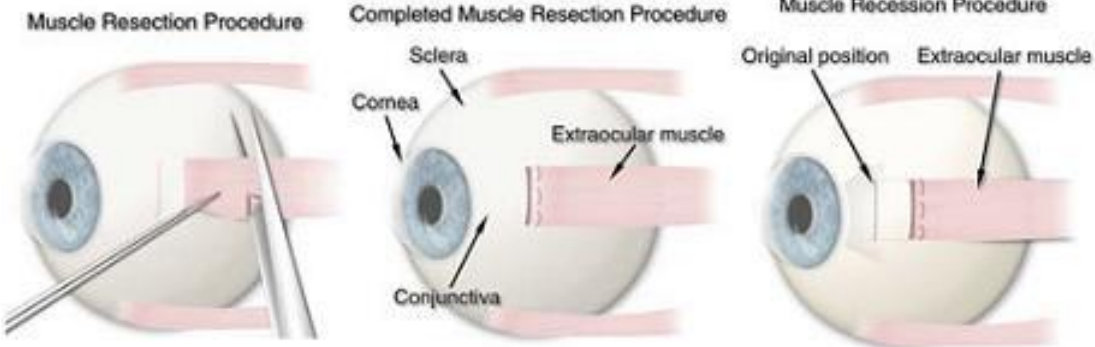
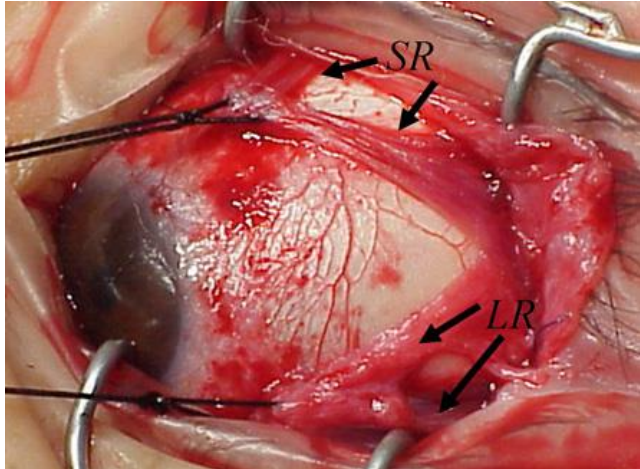
E. Muscles attaching to implant. Since the muscles will be attached to the prosthesis, the eye movement will be transferred to the prosthesis.



F. Conjunctiva (skin of the eye) closed over the implant.



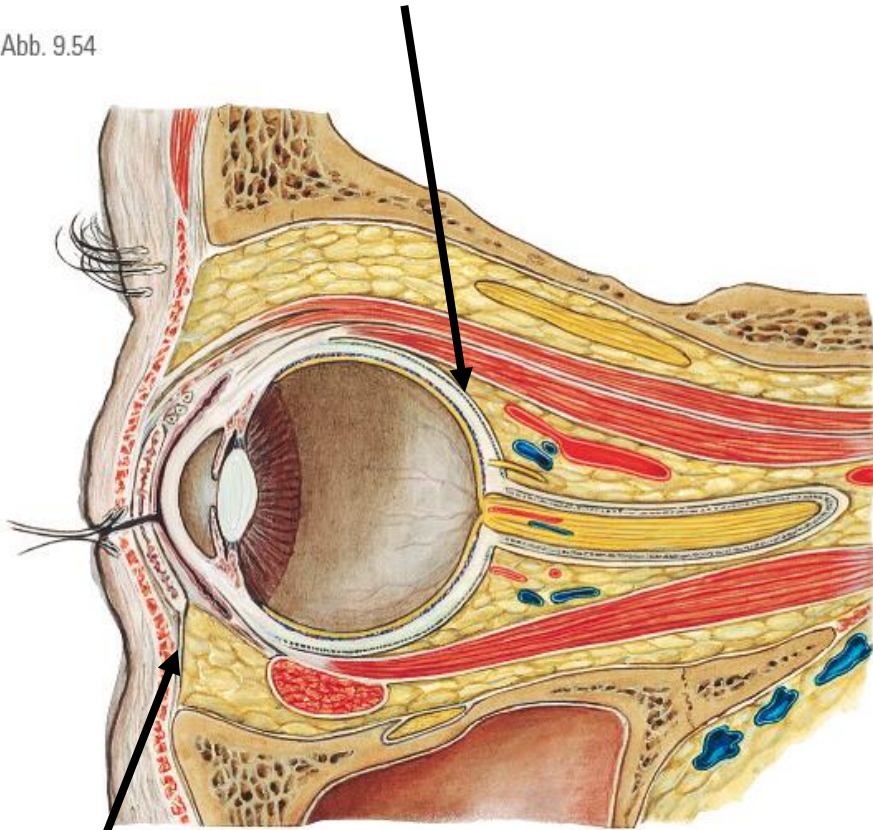
# Strabismus (Schielen)



# Das Bindegewebe und die glatte Muskulatur der Orbita

Vagina bulbi (Tenon-Kapsel)

Abb. 9.54



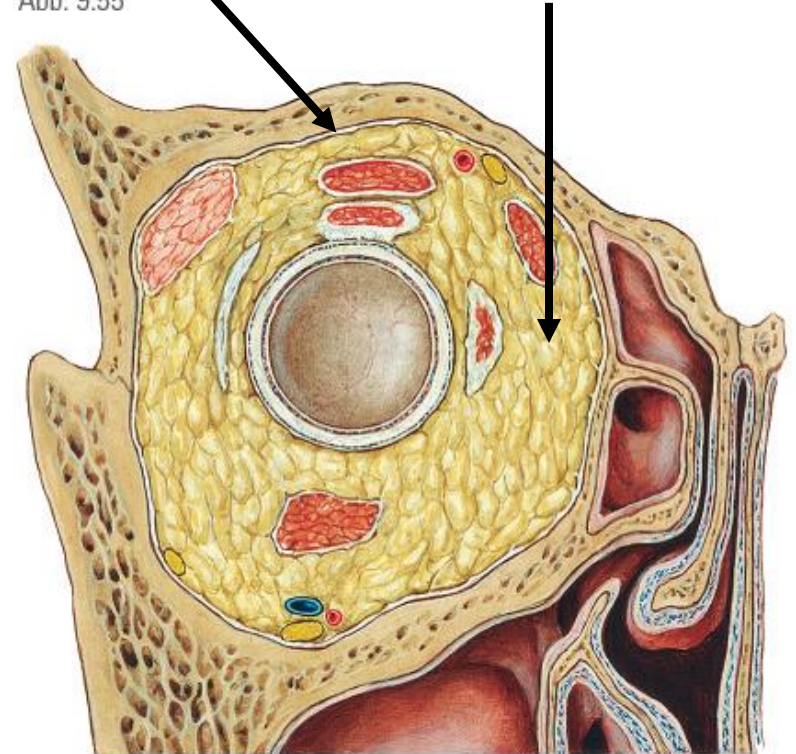
Sobotta - Atlas der Anatomie des Menschen, 23. A. 2010, © Elsevier GmbH, München

Septum orbitale

Periorbita

Corpus adiposum orbitae

Abb. 9.55



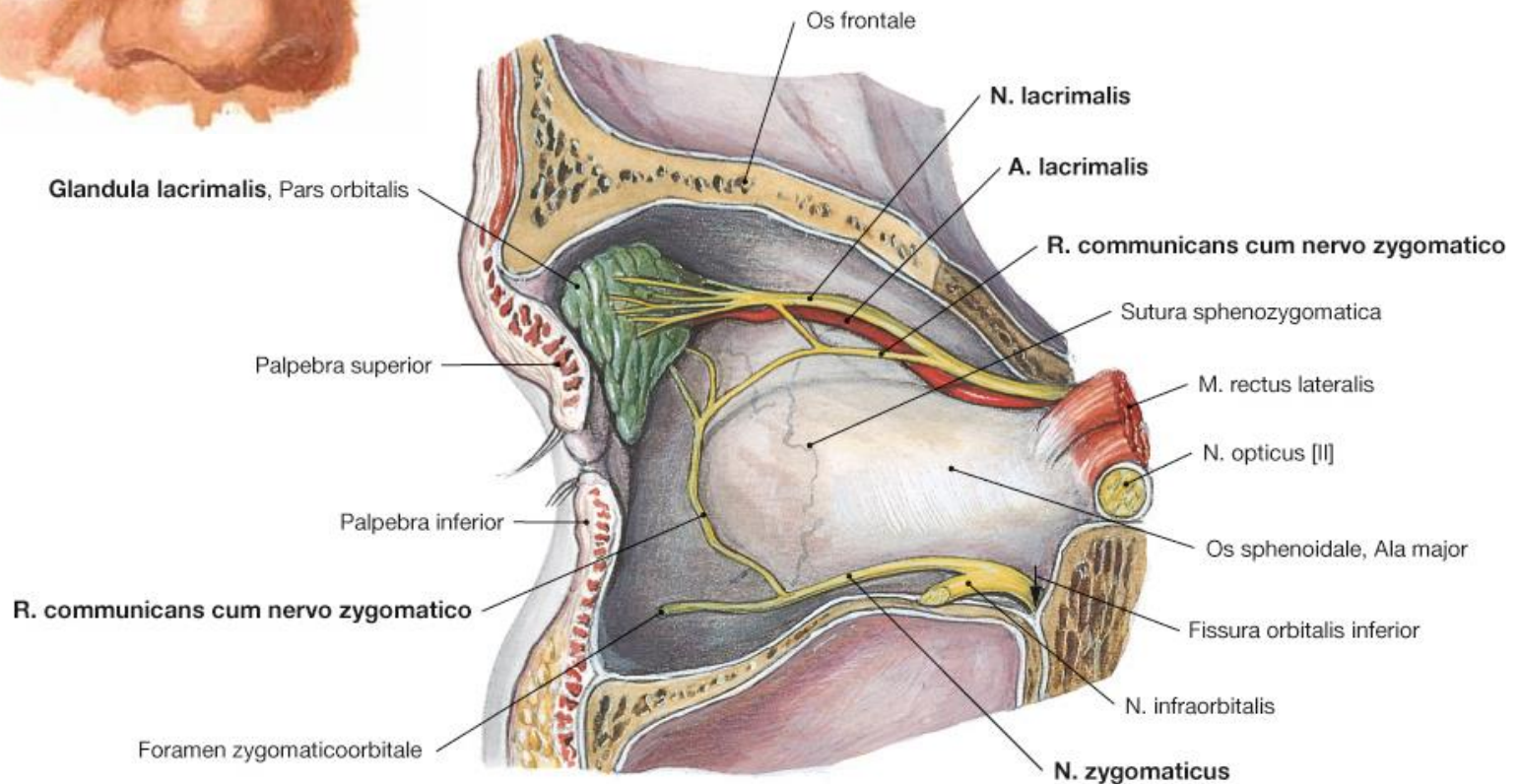
Sobotta - Atlas der Anatomie des Menschen, 23. A. 2010, © Elsevier GmbH, München

**Musculus orbitalis:** schwache mit der Periorbita verwachsene glatte Muskulatur bei der Fissura orbitalis inferior

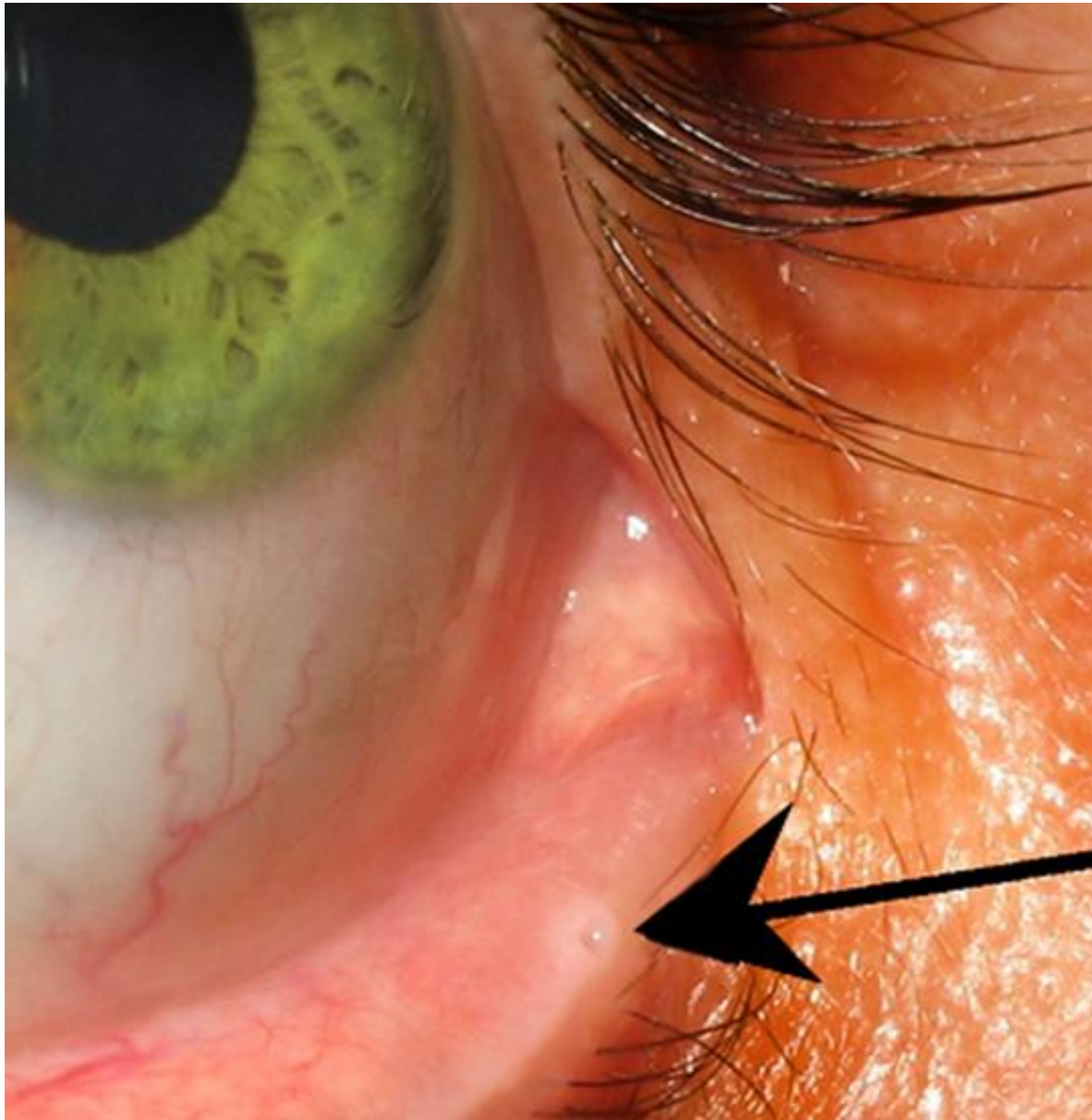
# Glandula lacrimalis

Allg. somatoafferente Innervation: Nervus trigeminus

Parasympathische Innervation: Nervus facialis



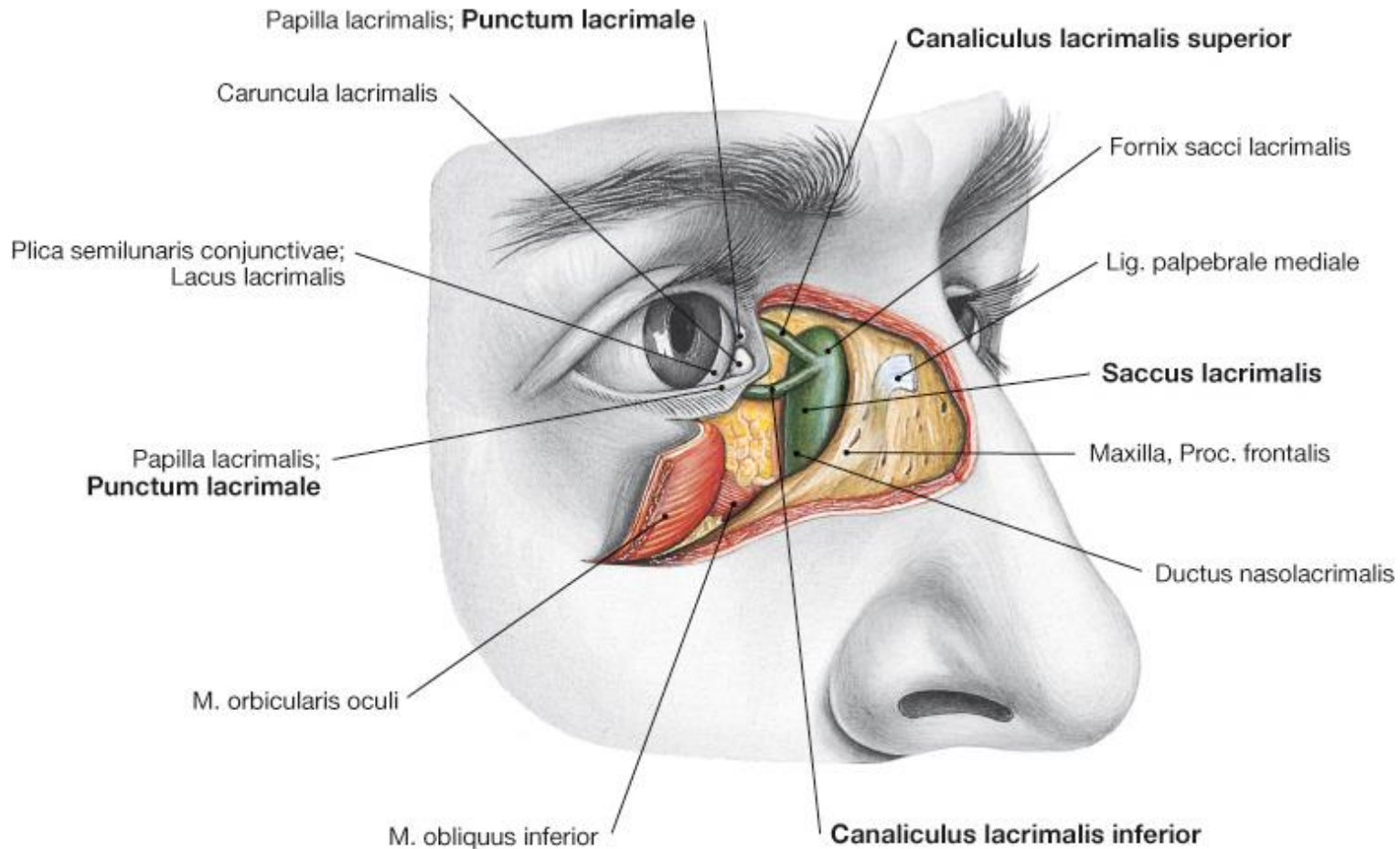
# Tränenwege: Punctum lacrimale



# Tränenwege

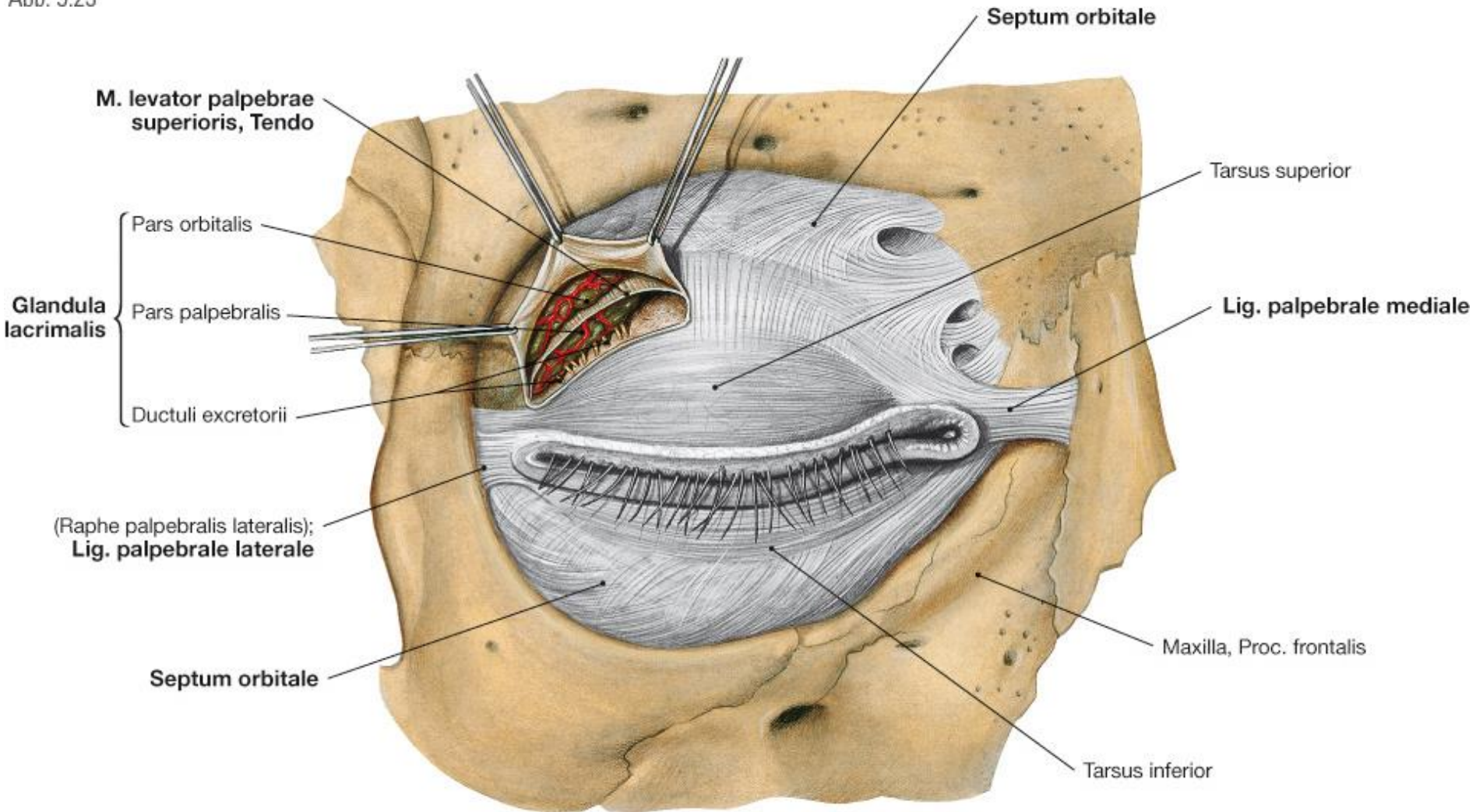


Abb. 9.32



# Palpebra: Tarsus

Abb. 9.23





**Eduard Zeis**  
(1807 – 1868)



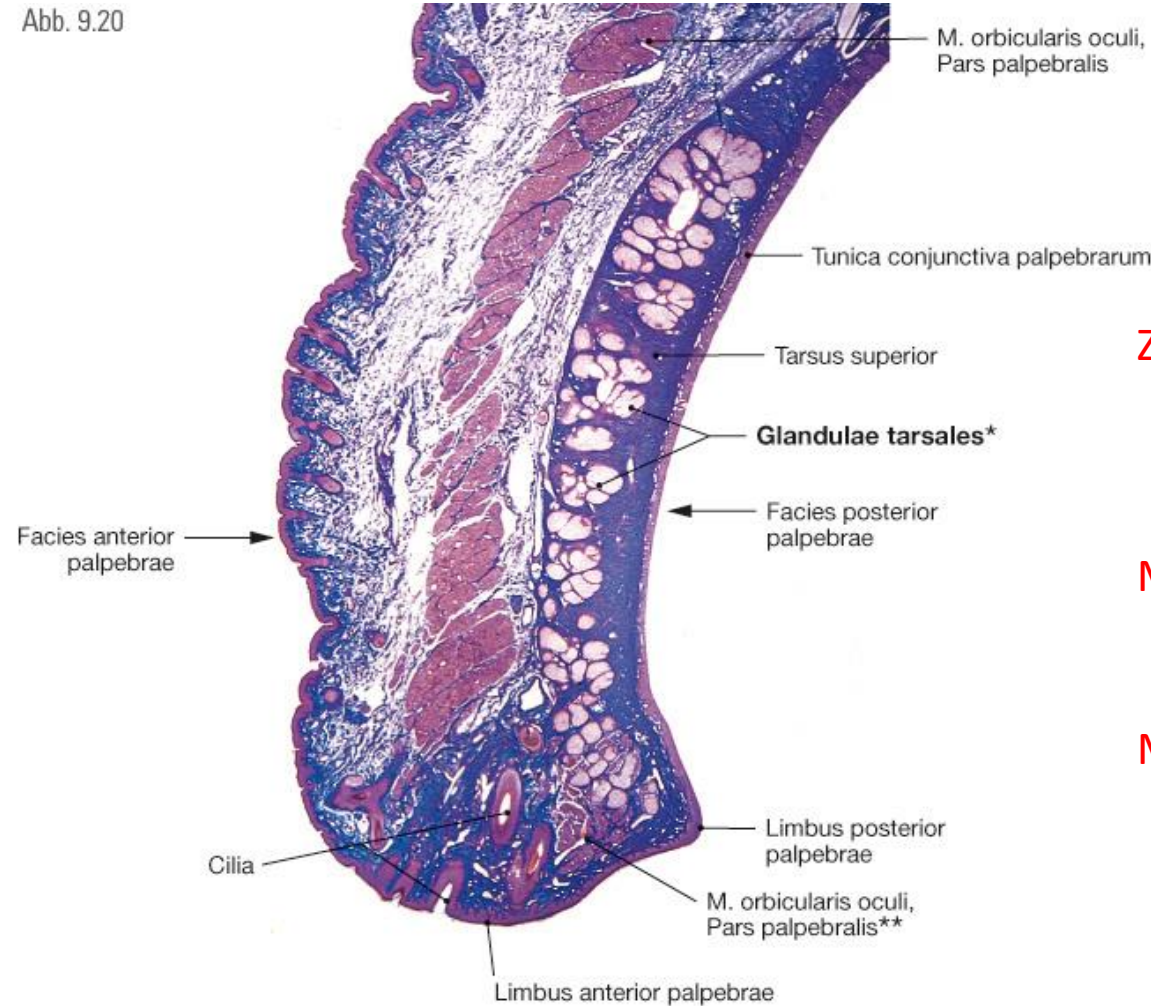
**Heinrich Meibom**  
(1638 – 1700)



**Jacob Anton Moll**  
(1832 – 1914)

# Palpebra: Drüsen

Abb. 9.20



**Zeis-Drüse:** Haarfollikel-assoziierte Talgdrüse

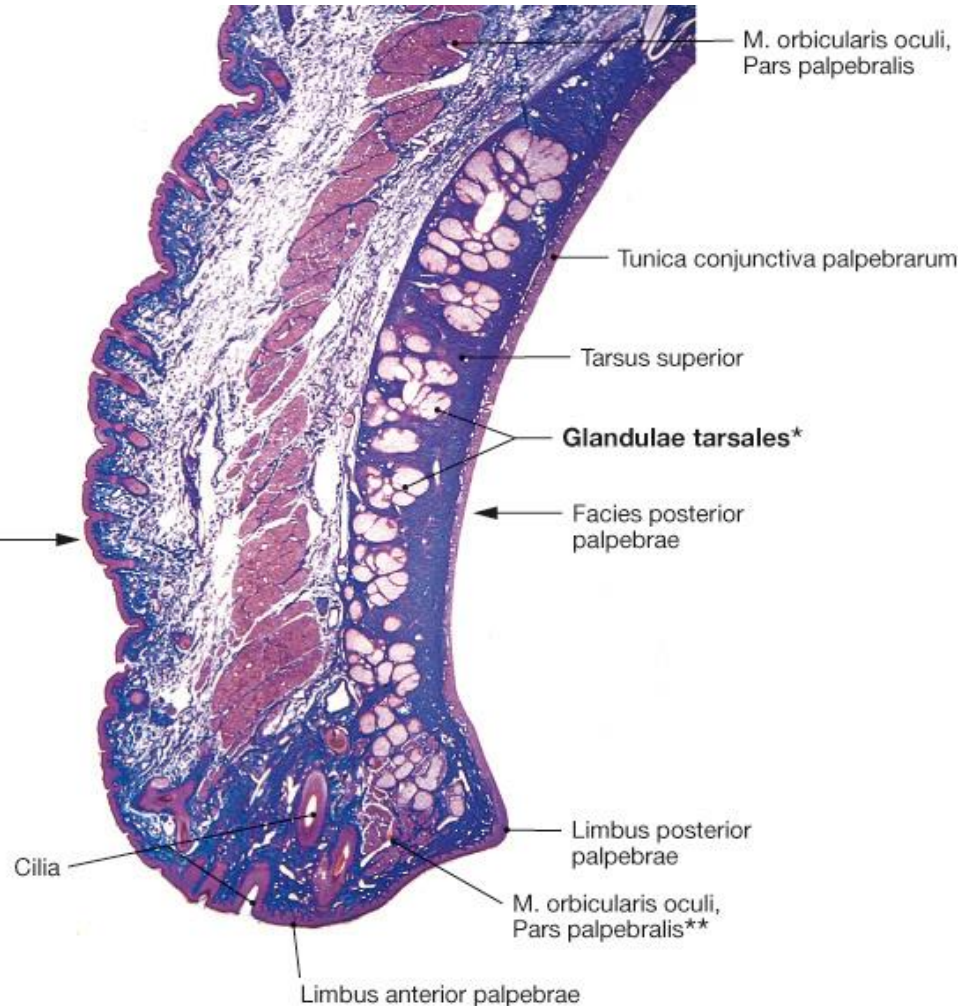
**Meibom-Drüse:** Talgdrüsen im Tarsus

**Moll-Drüse:** Apokrine Drüse



# Palpebra: Muskeln

Abb. 9.20



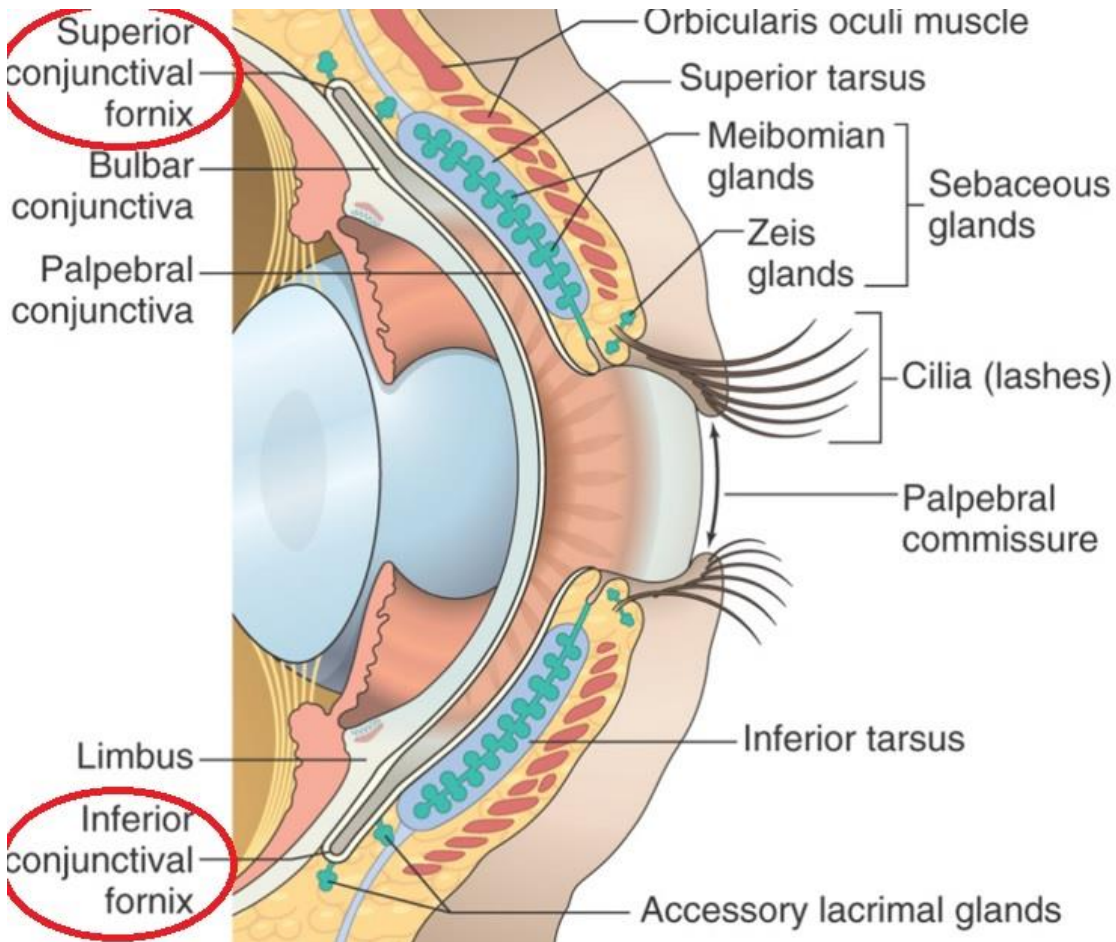
**M. levator palpebrae sup.**  
(N. oculomotorius)

**M. orbicularis oculi**  
(N. facialis)

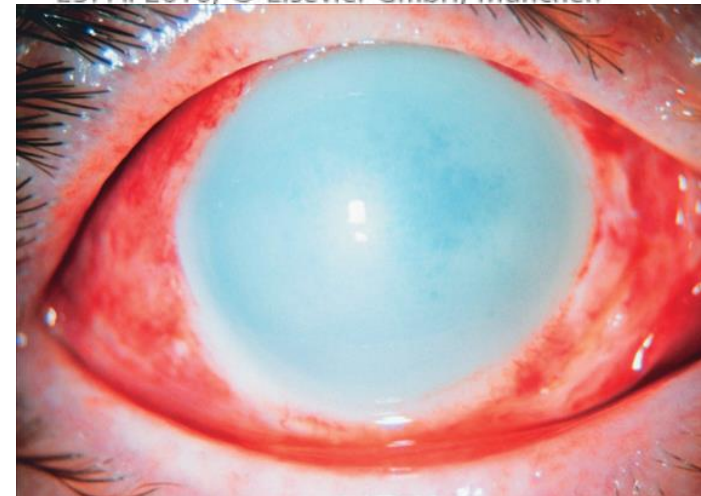
**M. tarsalis**  
(glatte Muskulatur - Sympathikus)

# Klinische Bezüge: Fremdkörper

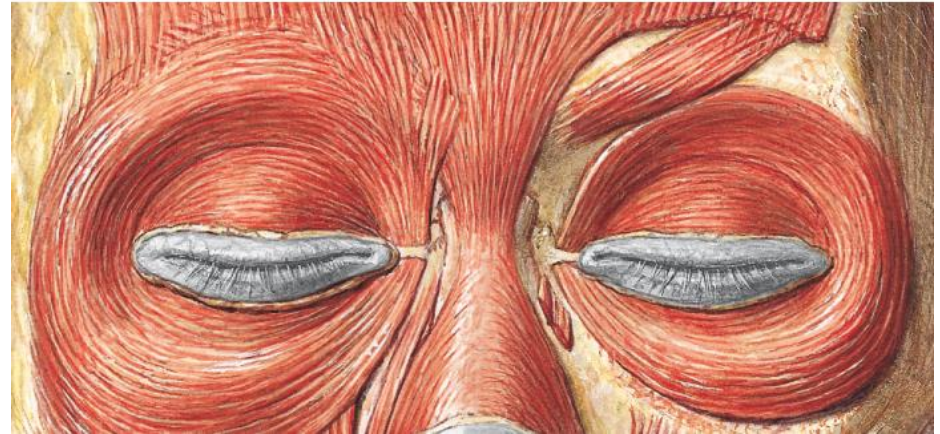
Abb. 9.17



Sobotta – Atlas der Anatomie des Menschen, 23. A. 2010, © Elsevier GmbH, München



# Klinische Bezüge: Lagophthalmus



**Nervus facialis Parese!!!**

# Klinische Bezüge: Ptosis (Ptose)



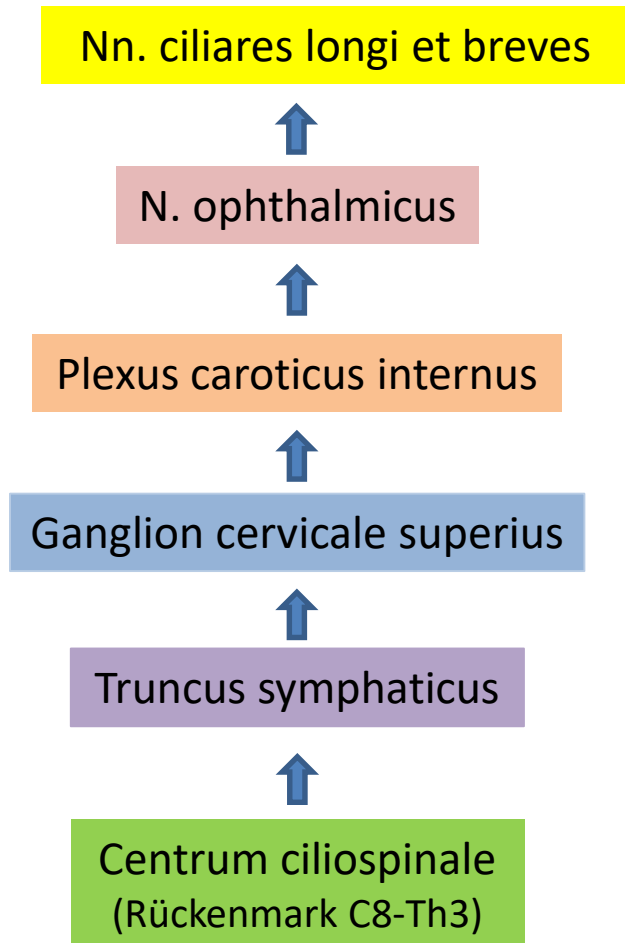
- Habitual (Angeboren)
- M. levator palpebrae sup. (N. oculomotorius)
- M. tarsalis (Sympathikus)

# Klinische Bezüge : Horner-Trias



Johann Friedrich  
Horner  
(1831 – 1886)

## Sympathische Innervation des Auges



**Horner-Trias:** Ptosis (m. tarsalis)  
Miosis (m. dilatator pupillae)  
Enophthalmus (m. orbitalis)



**Robert James  
Graves**  
(1796 – 1853)

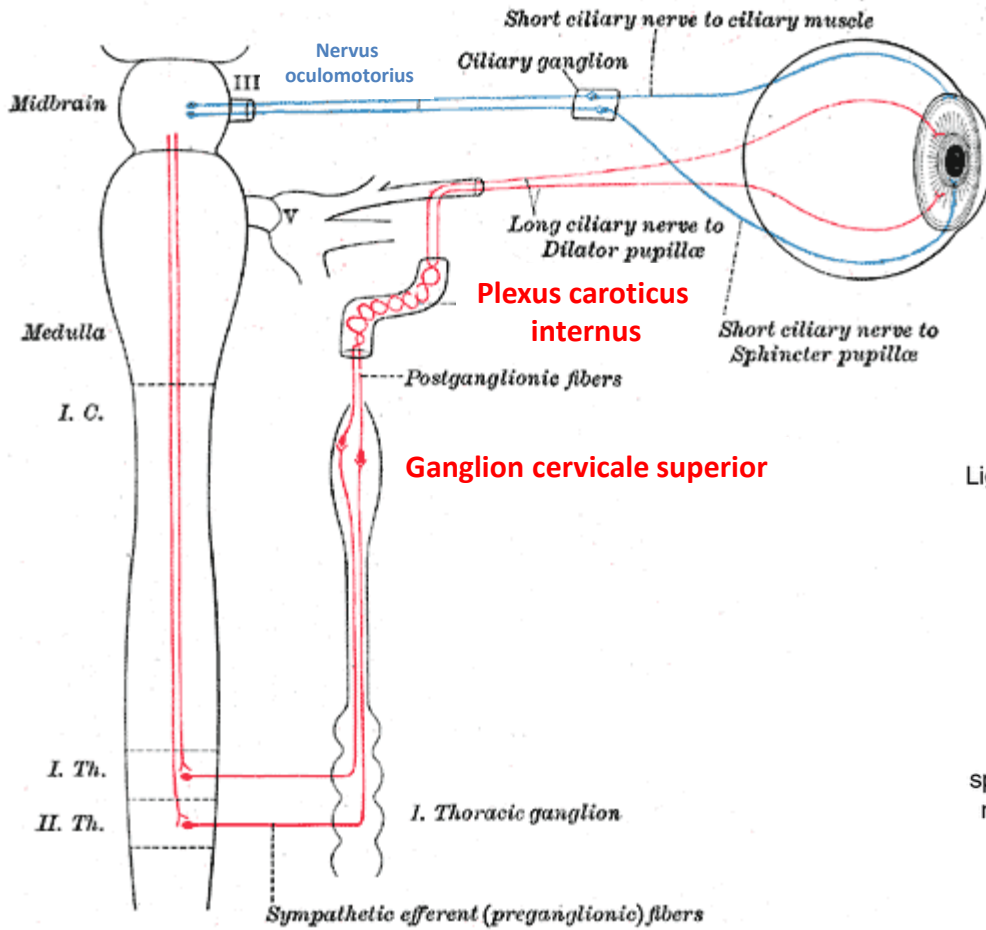
# Klinische Bezüge: Exophthalmus



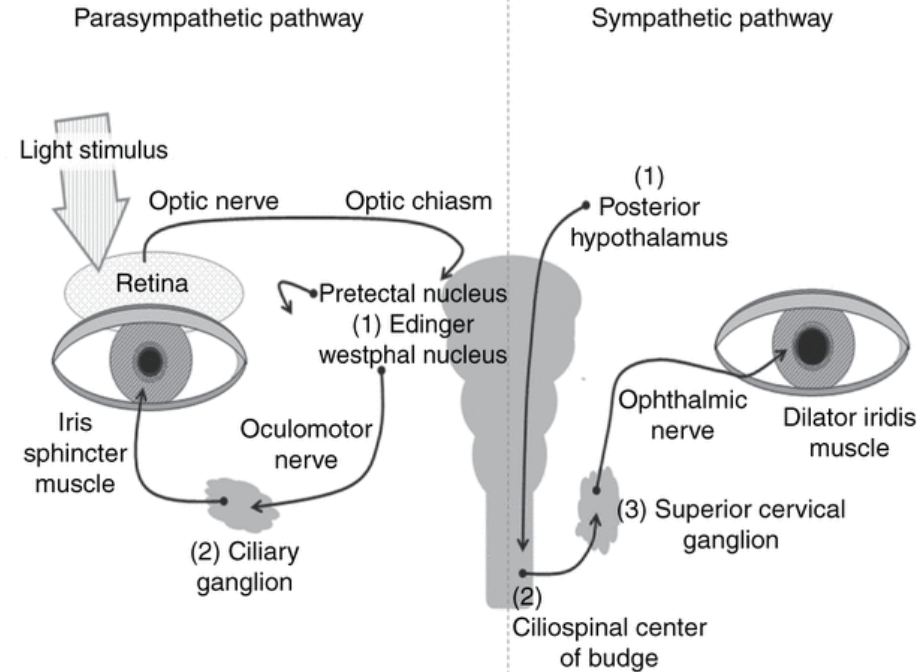
**Karl Adolph  
von Basedow**  
(1799 – 1854)



# Sympathische Innervation



**Centrum ciliospinale  
(C8-Th2/3)**



Mesencephalon

# Ganglion ciliare

## Vegetative Innervation des Auges

N. Westphal-Edinger (III.)

M. ciliaris,  
M. sphincter pupillae

Nn. ciliares breves

R. inf. n. oculomotorii  
Radix brevis (motoria)

Ganglion trigeminale

Pons

Ganglion ciliare

Lemniscus trigeminalis

Nucleus sensorius n. V.

N. nasociliaris  
Radix longa (sensoria)

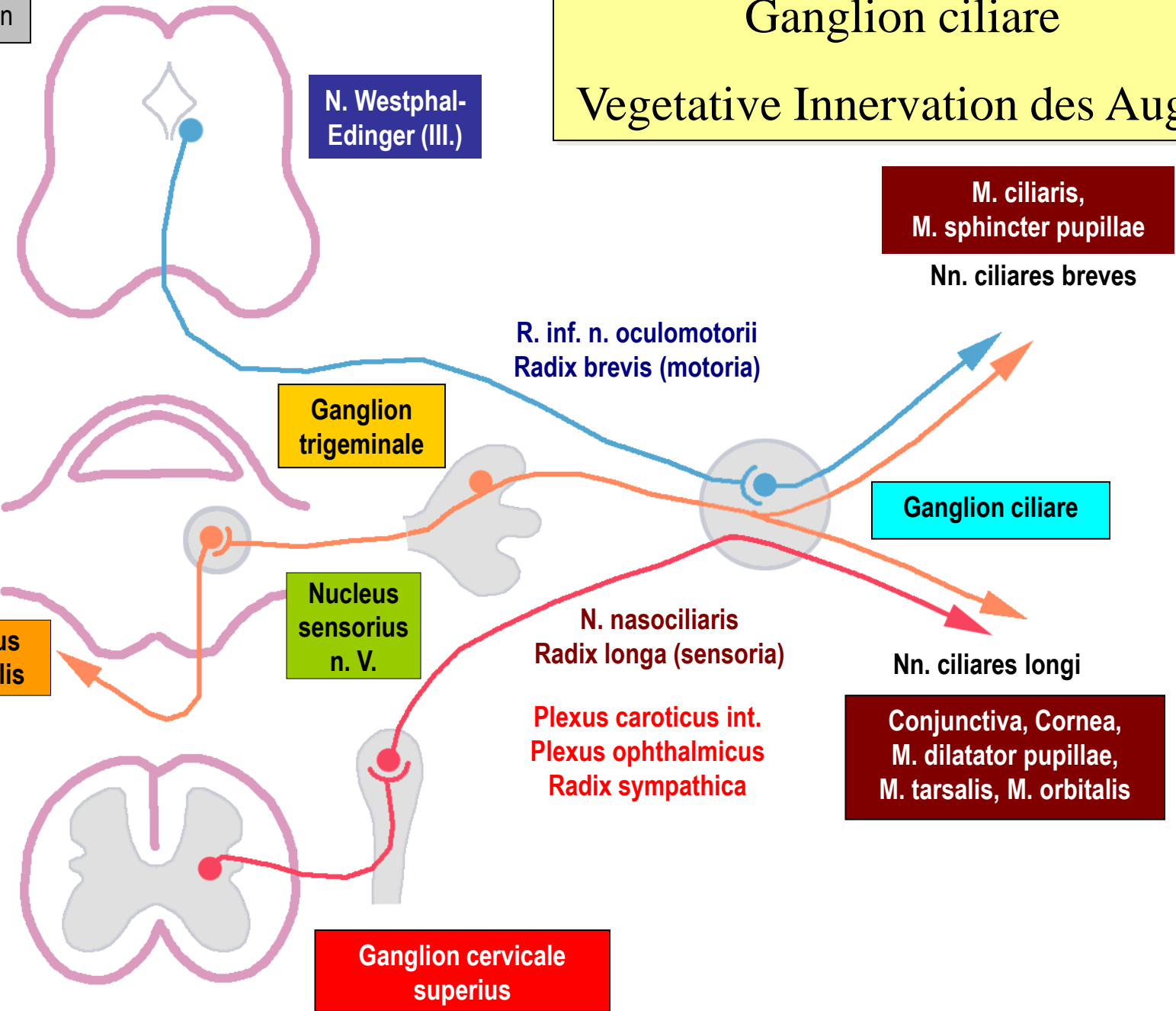
Nn. ciliares longi

Plexus caroticus int.  
Plexus ophthalmicus  
Radix sympathica

Conjunctiva, Cornea,  
M. dilatator pupillae,  
M. tarsalis, M. orbitalis

Medulla spinalis

Ganglion cervicale superius





# Angewendete Literatur

- Benninghoff, Drenckmhahn: Anatomie, *16. Auflage, Elsevier Urban Fischer, Stuttgart*
- Paulsen, Waschke: Sobotta Atlas der Anatomie des Menschen, *23. Auflage Urban & Fischer Verlag*
- Schünke, Schulte, Schumacher, Voll, Wesker: Prometheus LernAtlas der Anatomie, *1. Auflage, Thieme*
- Drake, Vogl, Mitchell: Gray's Anatomie für Studenten, *1. Auflage Urban & Fischer Verlag*
- <http://12cranialnerves.wordpress.com/>