Autonomic nervous system

Innervation of

smooth muscle

myocardium

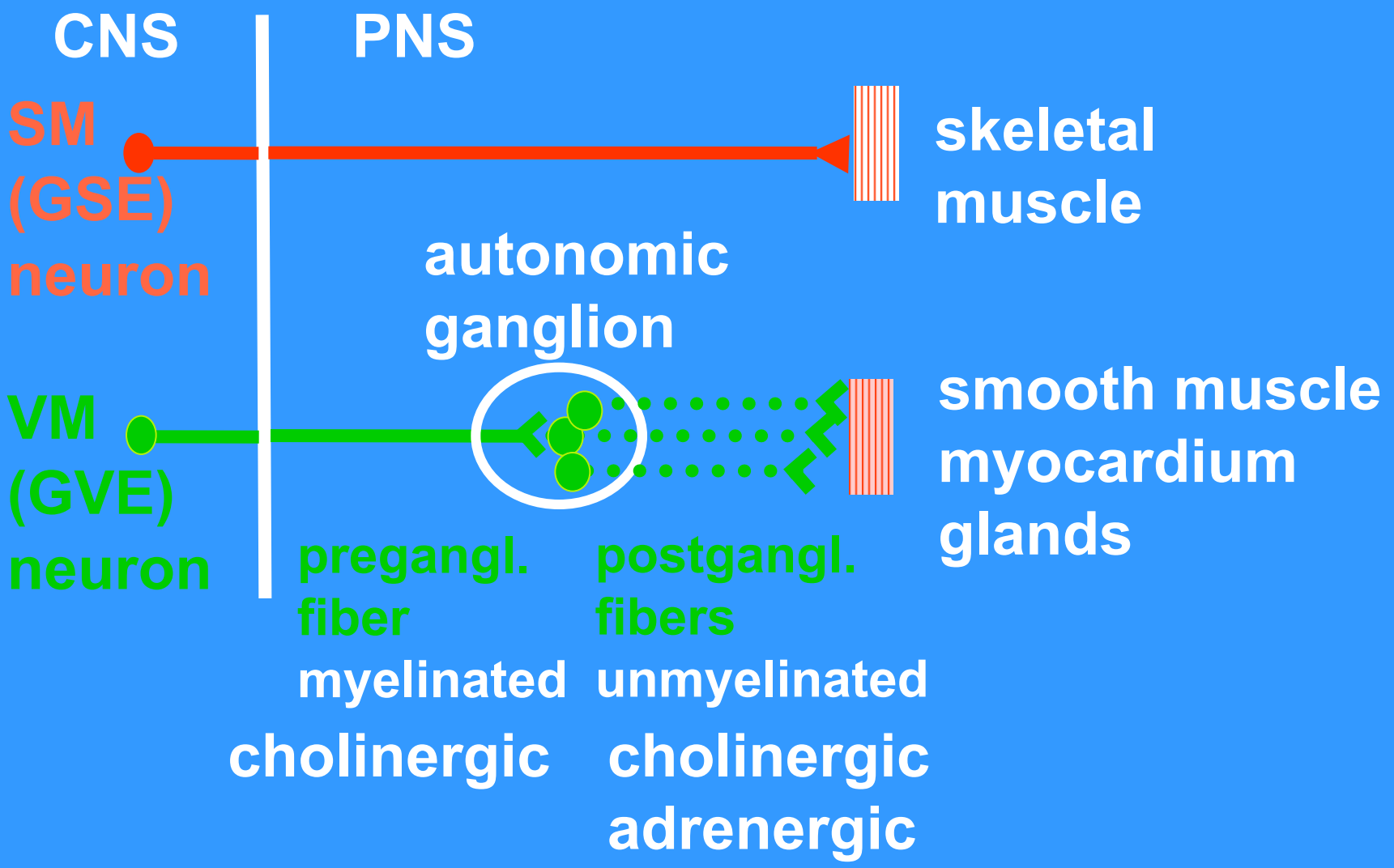
glands

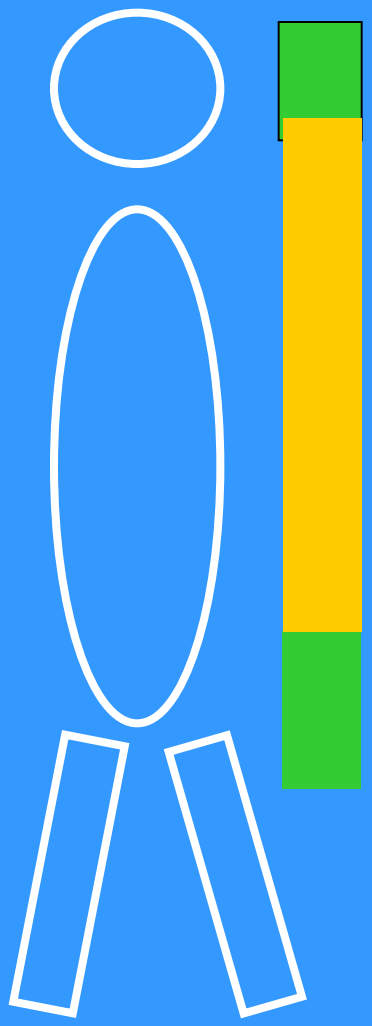
relative independence on cortex
neurons in both CNS and PNS

functionally is divided into:

sympathetic system
parasympathetic system
enteric system

afferent (viscerosensory) fibers
accompany efferent fibers


CNS
PNS
SM
(GSE)
neuron
skeletal
muscle
autonomic
ganglion
VM
(GVE)
neuron
smooth muscle
myocardium
glands
pregangl.
fiber
myelinated
cholinergic
postgangl.
fibers
unmyelinated
cholinergic
adrenergic



cranial parasympathetic system

sympathetic thoracic-lumbar system

sacral parasympathetic system

Sympathetic system

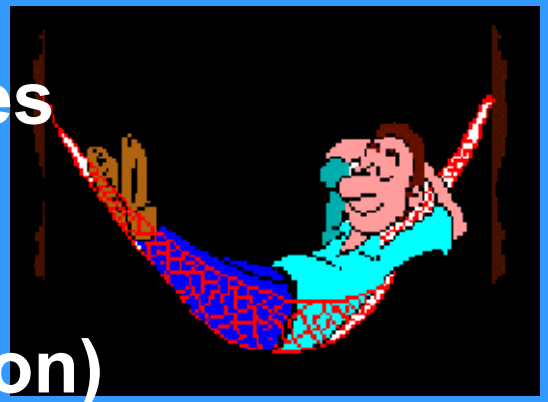
Catabolic reaction (activities that are mobilized during emergency and stress situations, "fight, fright and flight" responses)

- dilates coronary arteries
- increases heart rate
- increases cardiac output
- dilates bronchi
- inhibits GIT motility
- dilates pupil (mydriasis)
- stimulates sweat glands secretion
- stimulates secretion of viscous saliva

Parasympathetic system

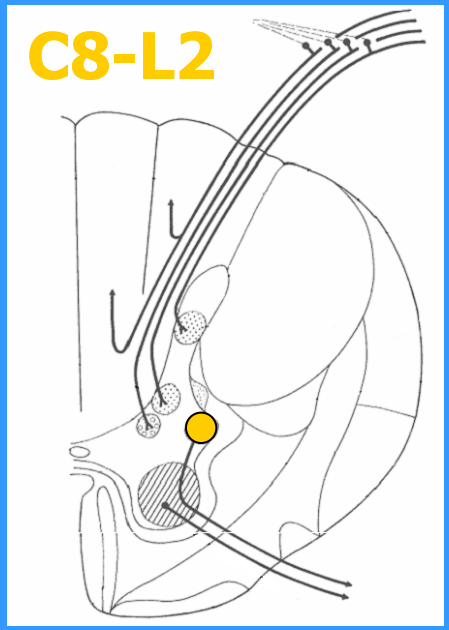
Anabolic reactions (activities associated with conservation and restoration of body resources)

decreases heart rate
decreases cardiac output
constricts coronary arteries
constricts bronchi
constricts pupil (miosis)
accommodation (near vision)
increases GIT motility
stimulates secretion of watery saliva



Sympathetic system

Central part:
ncl. intermediolateralis



Peripheral part:
pregangl. fibres
rr.com. albi

Ganglion

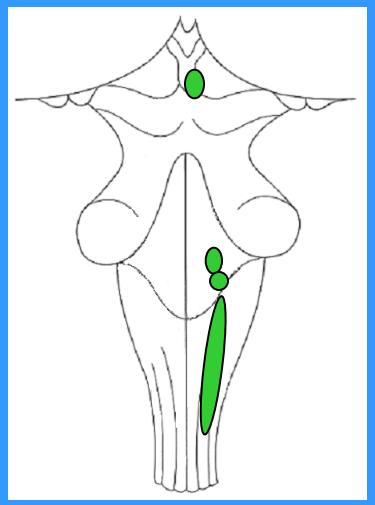
postgangl. fibres

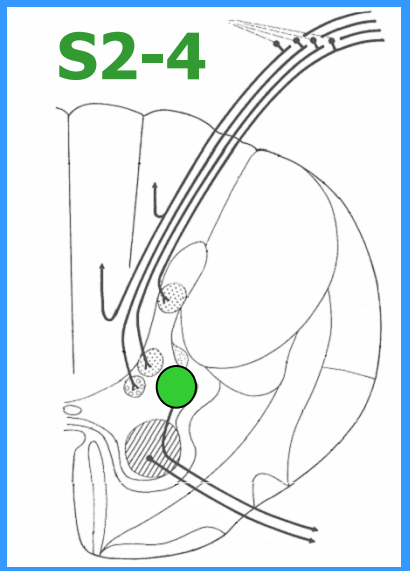
Acetylcholine

Noradrenalin

Parasympathetic system

Central part:
CN III, VII, IX, X
ncl. intermediolat.





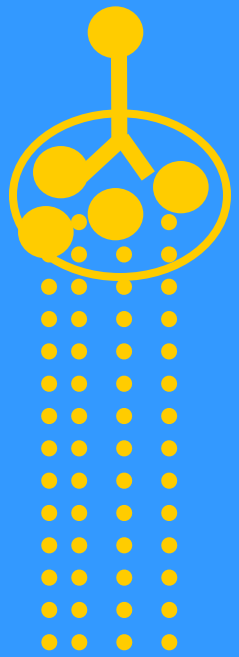
Peripheral part:

Ganglion

pregangl. fibres → postgangl. fibres

Acetylcholine **Acetylcholine**

Ganglia



para
vertebral

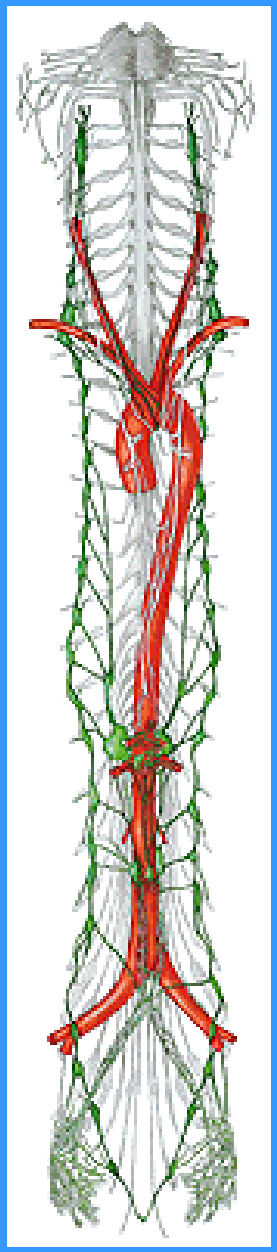
pre
vertebral

Ciliare, oticum, submand., pterygop. Ggll. in organs

Symp. trunk

Aortic plexuses

	Sympathetic	Parasympathetic
heart rate	increase	decrease
coronary arteries	dilation	constriction
bronchioles	relaxation	constriction
pupil	dilation (mydriasis) 	constriction (miosis) 
gall bladder	contraction	relaxation
salivary secretion	viscous	watery
GIT	inhibition of peristalsis	acceleration of peristalsis



I. Pars sympat.

Paravertebral ganglia

truncus symphaticus

cervical 3

thoracic 10 - 11

lumbar 4 - 5

sacral 4 - 5

ganglion impar

Prevertebral ganglia

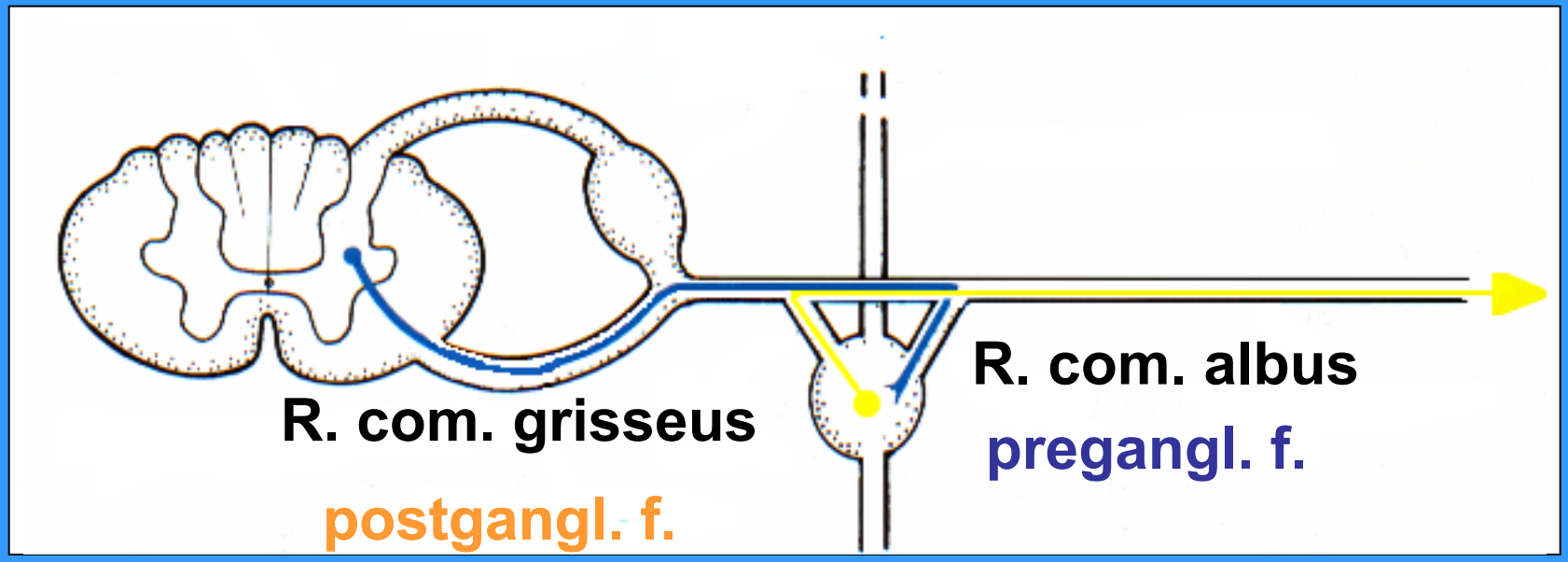
coeliacum

mesentericum sup.

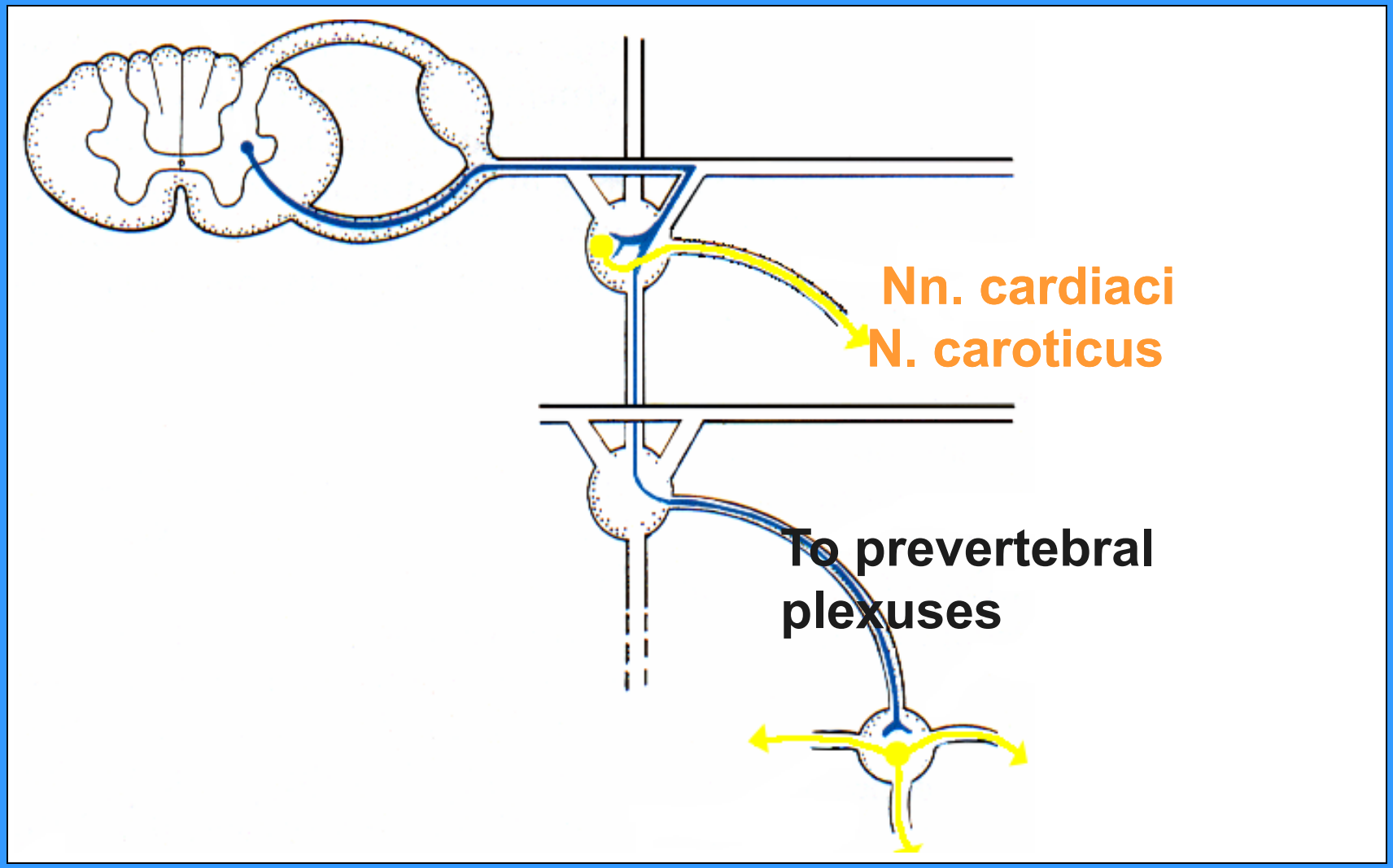
aorticorenale

mesentericum inf.

Ganglia tr. sympathici

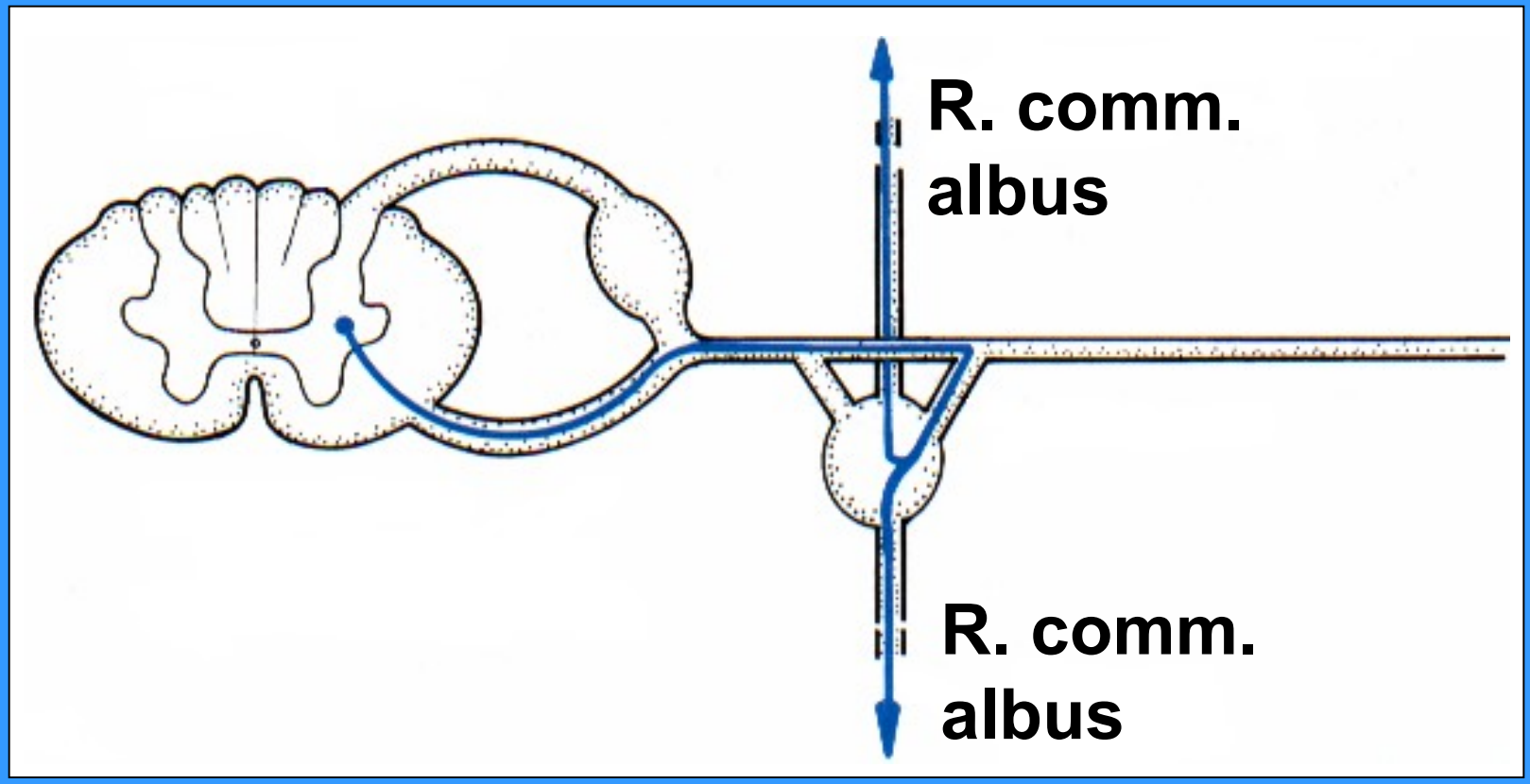


rr. viscerales
rr. vasculares

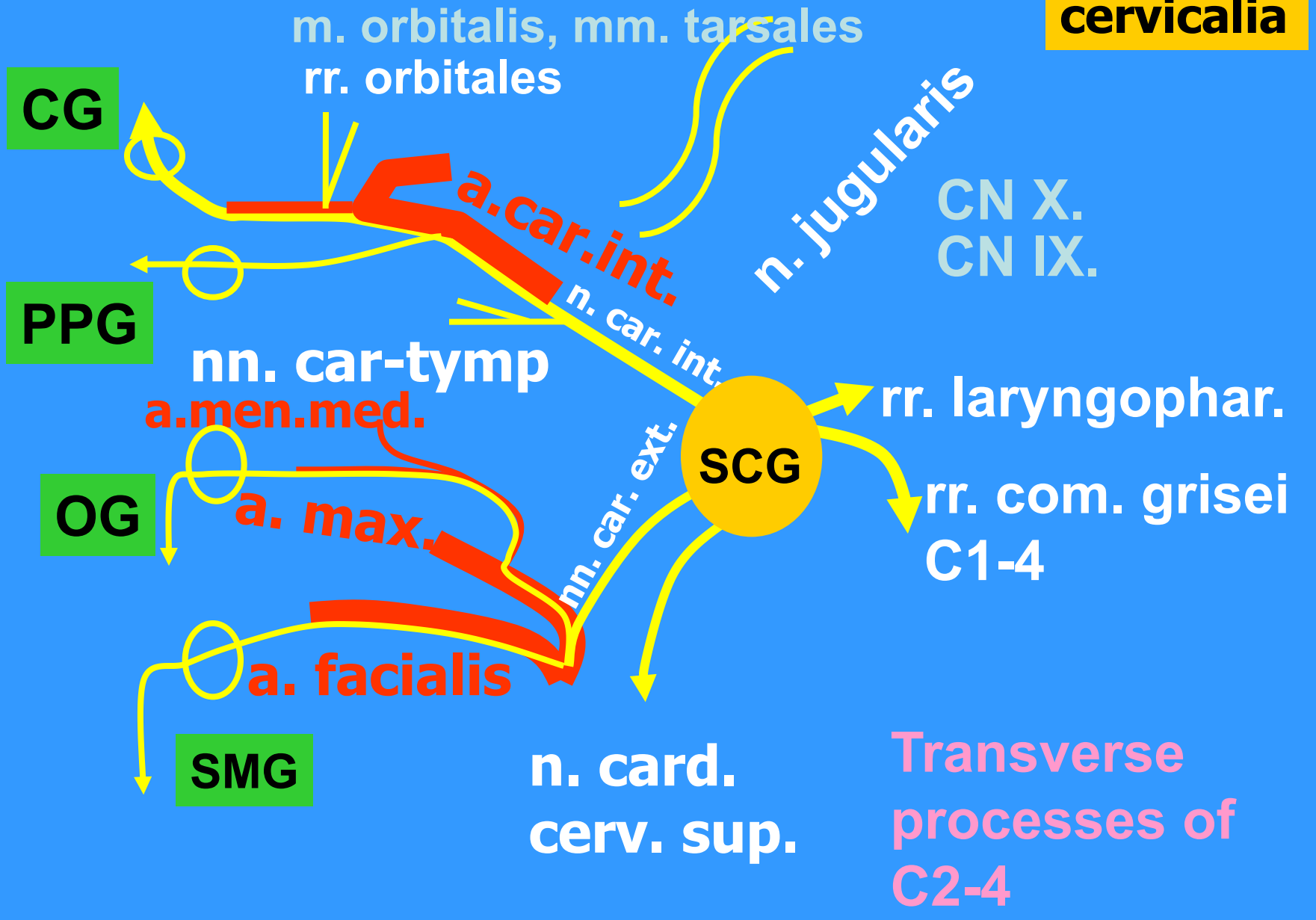


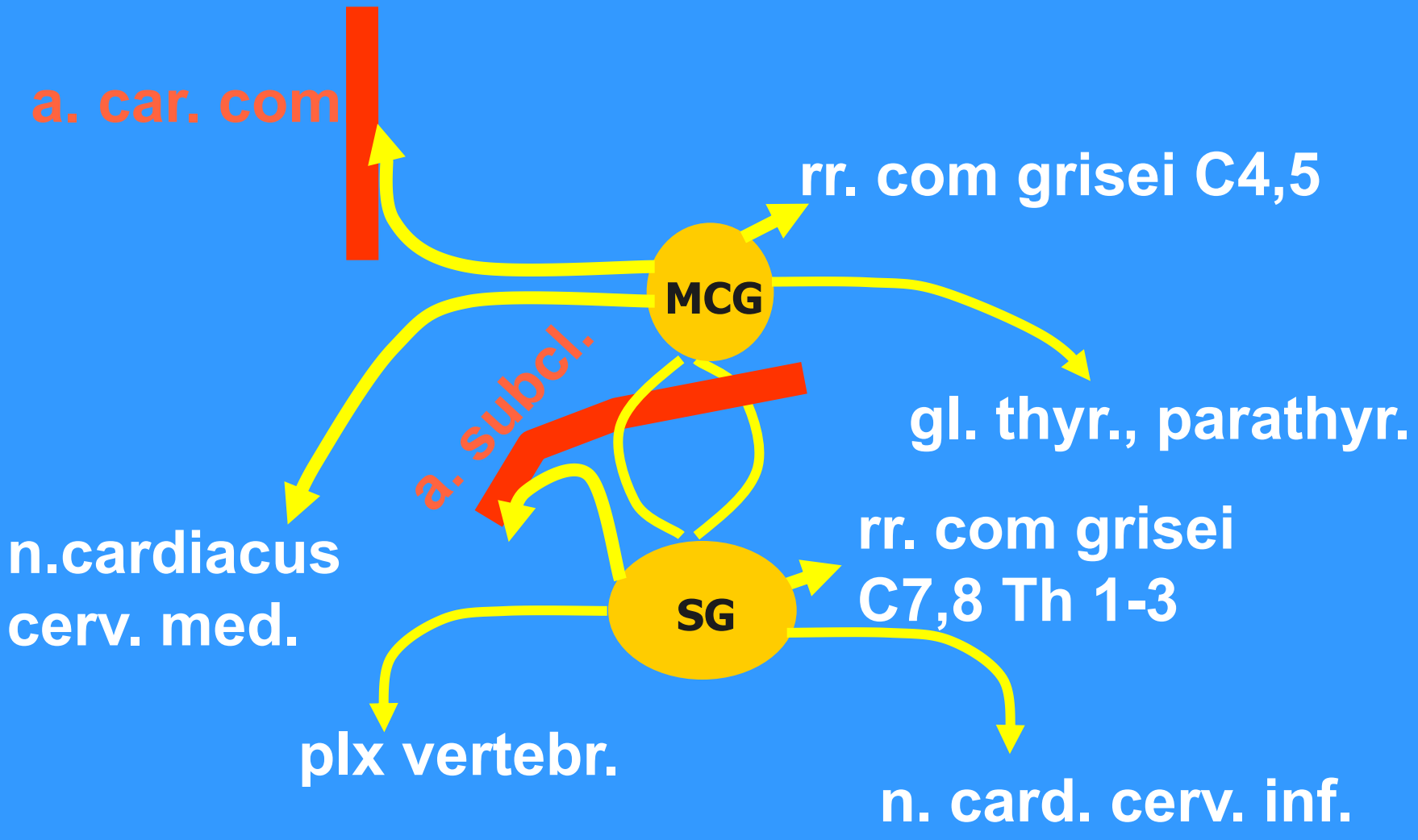
nn. splanchnici

rr. interganglionares



Ganglia cervicalia




a. car. com
rr. com grisei C4,5
MCG
a. subcl.
gl. thyr., parathyr.
n.cardiacus
cerv. med.
rr. com grisei
C7,8 Th 1-3
SG
plx vertebr.
n. card. cerv. inf.
Transverse
processes of C 6,7

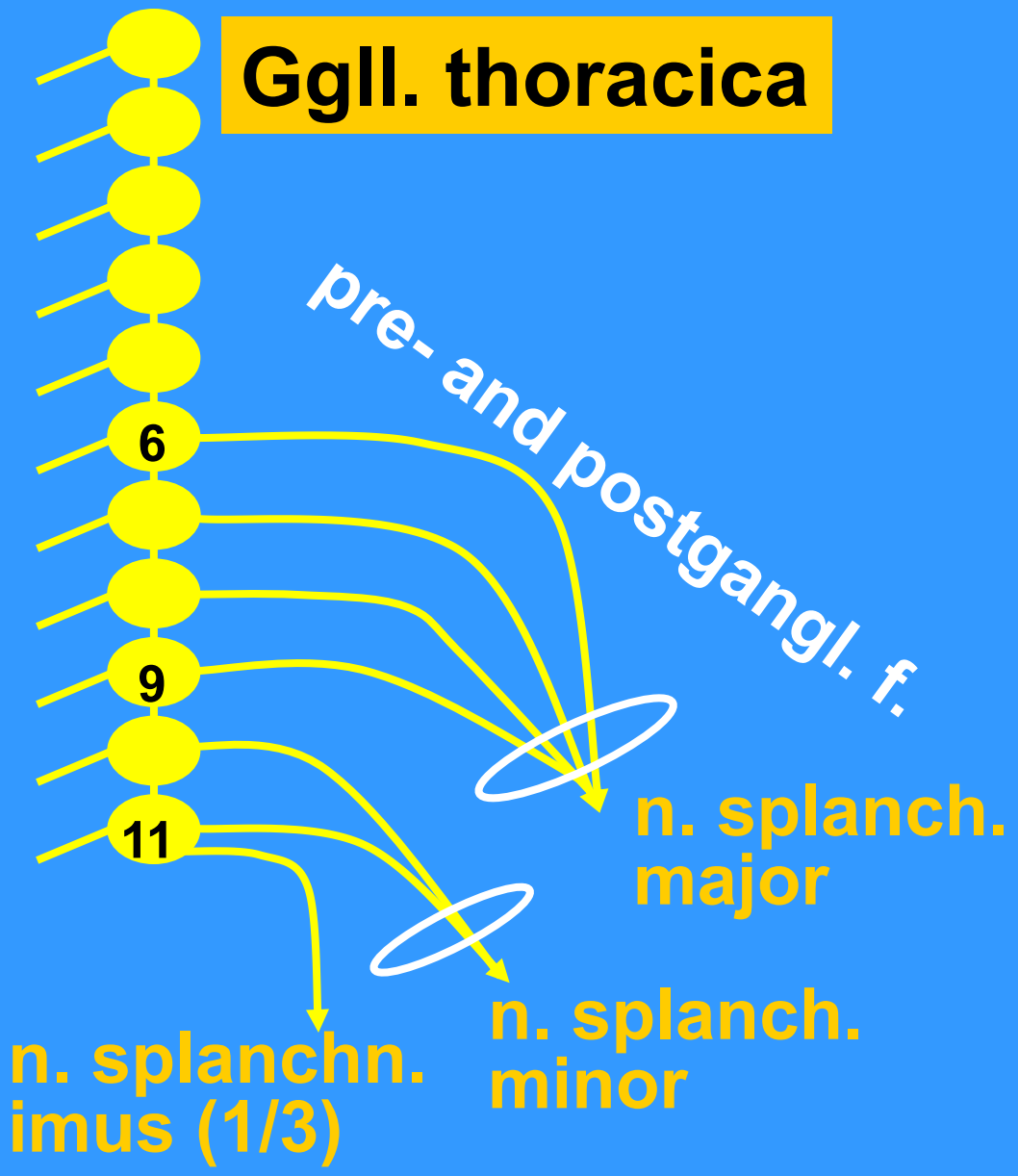
rr. com grisei
- nn. intercost.

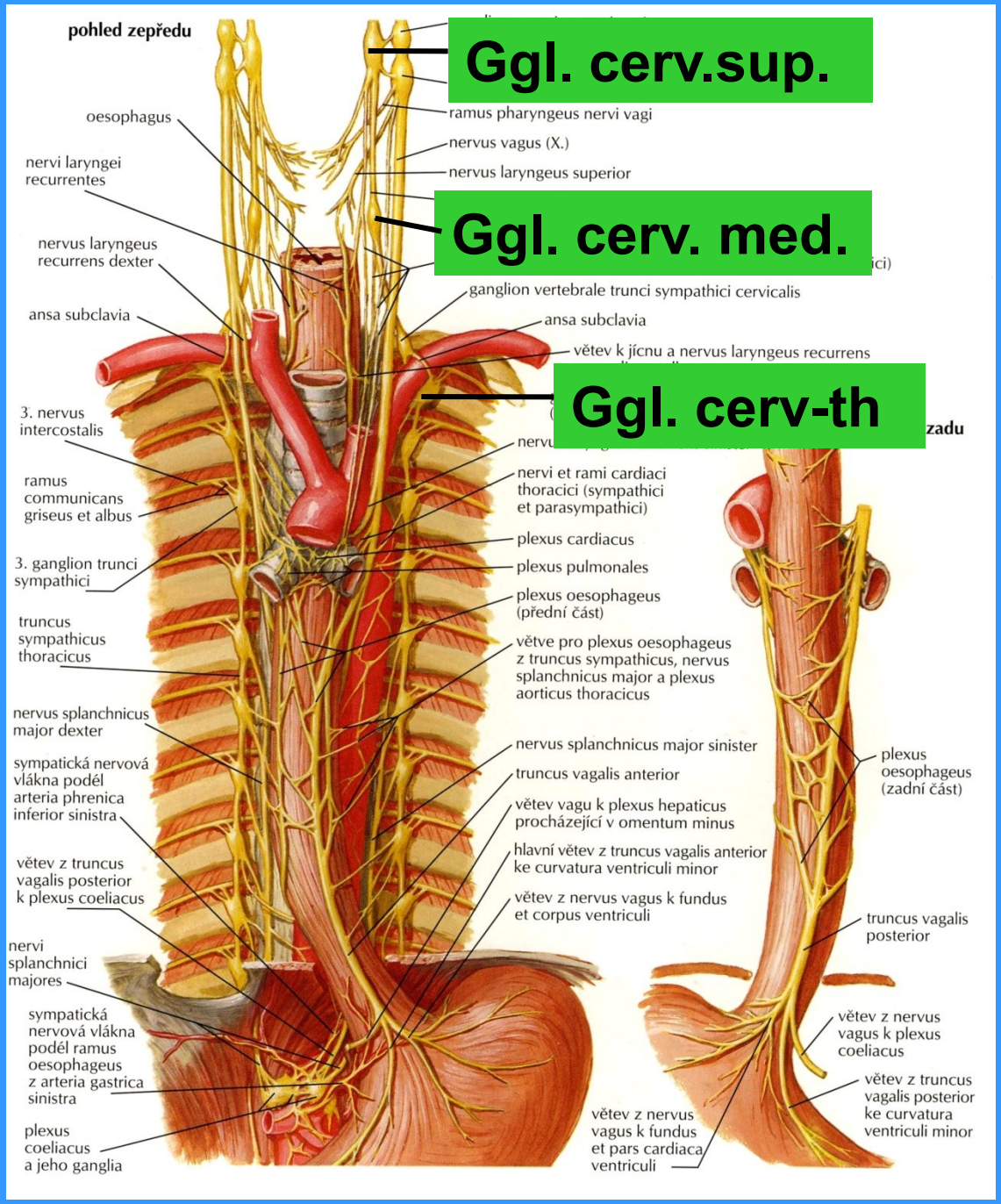
nn. cardiaci th.

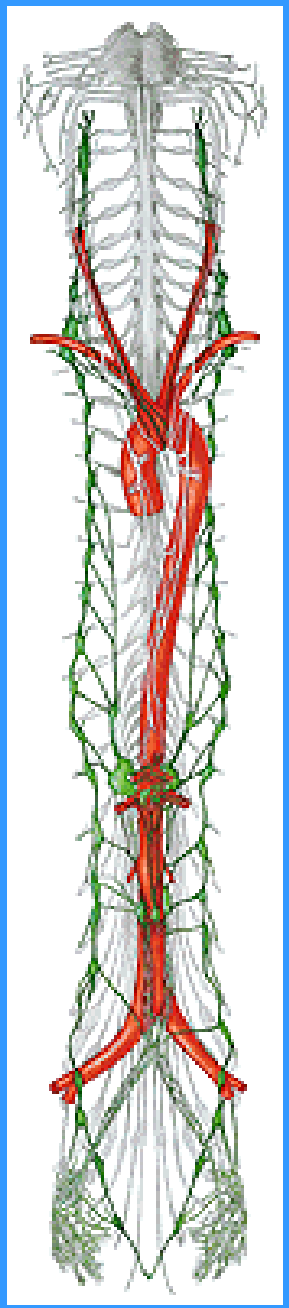
rr. pulmonales

rr. oesophagei

rr. vasculares
- aa. intercost.
- aorta > plx. aorticus thorac.

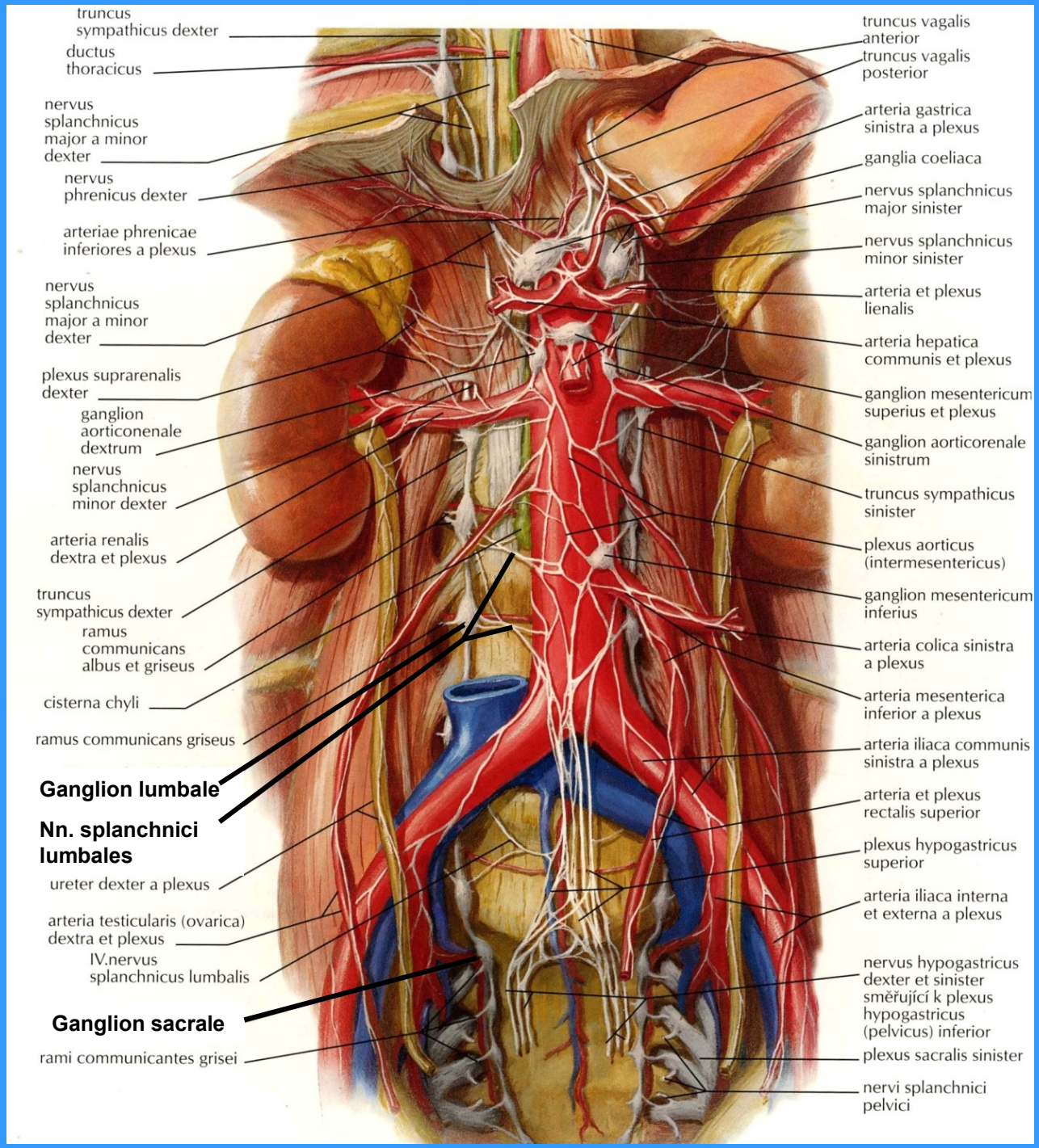


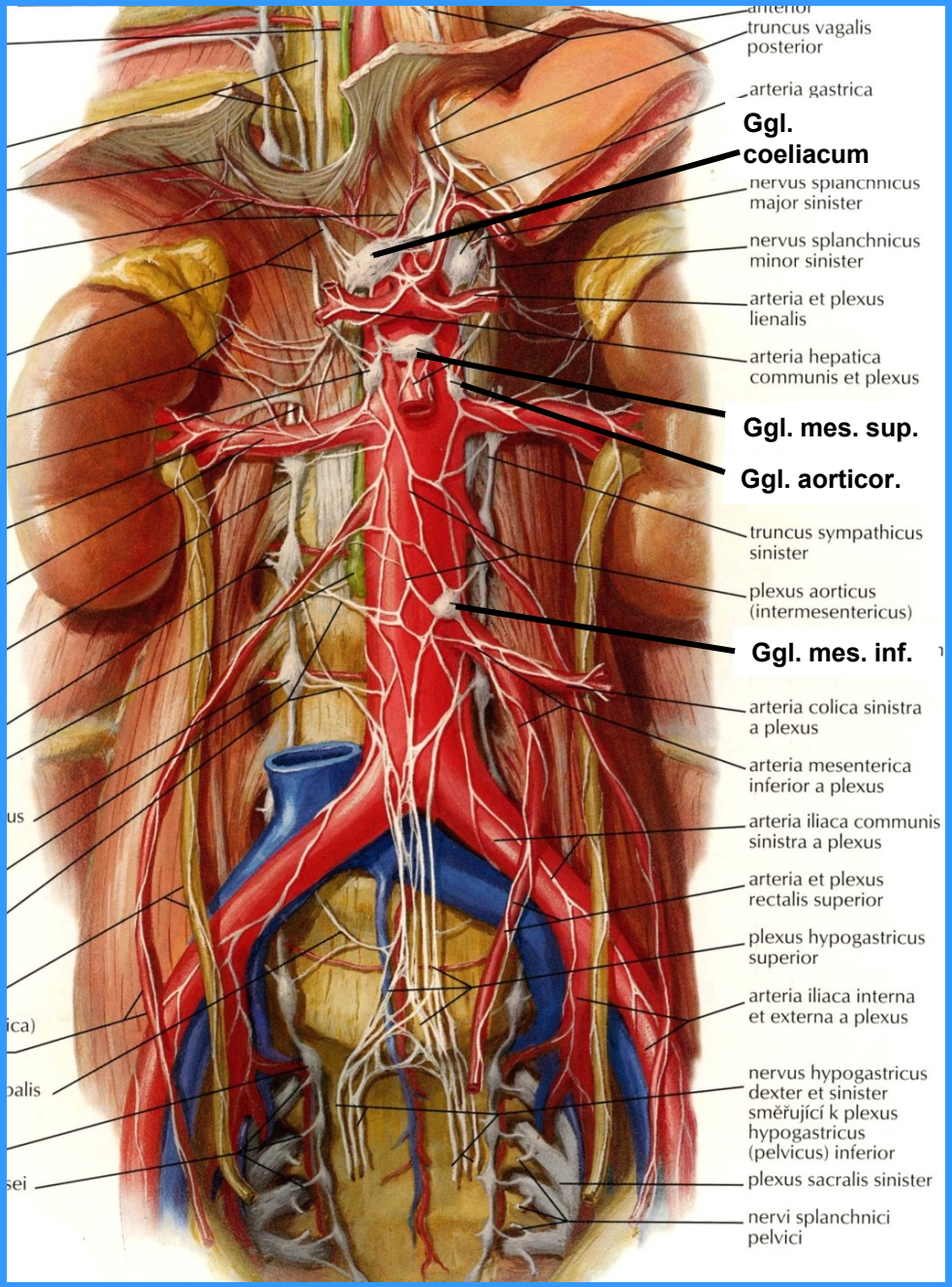

pohled zepředu
Ggl. cerv.sup.
Ggl. cerv. med.
Ggl. cerv-th
oesophagus
nervi laryngei recurrentes
nervus laryngeus recurrens dexter
ansa subclavia
3. nervus intercostalis
ramus communicans griseus et albus
3. ganglion trunci sympathici
truncus sympathicus thoracicus
nervus splanchnicus major dexter
sympatická nervová vlákna podél arteria phrenica inferior sinistra
větev z truncus vagalis posterior k plexus coeliacus
nervi splanchnici majores
sympatická nervová vlákna podél ramus oesophageus z arteria gastrica sinistra
plexus coeliacus a jeho ganglia
ramus pharyngeus nervi vagi
nervus vagus (X.)
nervus laryngeus superior
ganglion vertebrale trunci sympathici cervicalis
ansa subclavia
větev k jícnu a nervus laryngeus recurrens
nervi et rami cardiaci thoracici (sympathici et parasympathici)
plexus cardiacus
plexus pulmonales
plexus oesophageus (přední část)
větve pro plexus oesophageus z truncus sympathicus, nervus splanchnicus major a plexus aorticus thoracicus
nervus splanchnicus major sinister
truncus vagalis anterior
větev vagu k plexus hepaticus procházející v omentum minus
hlavní větev z truncus vagalis anterior ke curvatura ventriculi minor
větev z nervus vagus k fundus et corpus ventriculi
zadu
plexus oesophageus (zadní část)
truncus vagalis posterior
větev z nervus vagus k plexus coeliacus
větev z truncus vagalis posterior ke curvatura ventriculi minor
větev z nervus vagus k fundus et pars cardiaca ventriculi



Ganglia lumbalia	**4-5**
Ganglia sacralia	**4-5**
Ganglion impar	**1**

Rr. com. grisei (L1 – Co)
Nn. splanch. lumb. (plx. aorticus abd.)
Nn. splanch. sacrales (plx. hypogastr.)

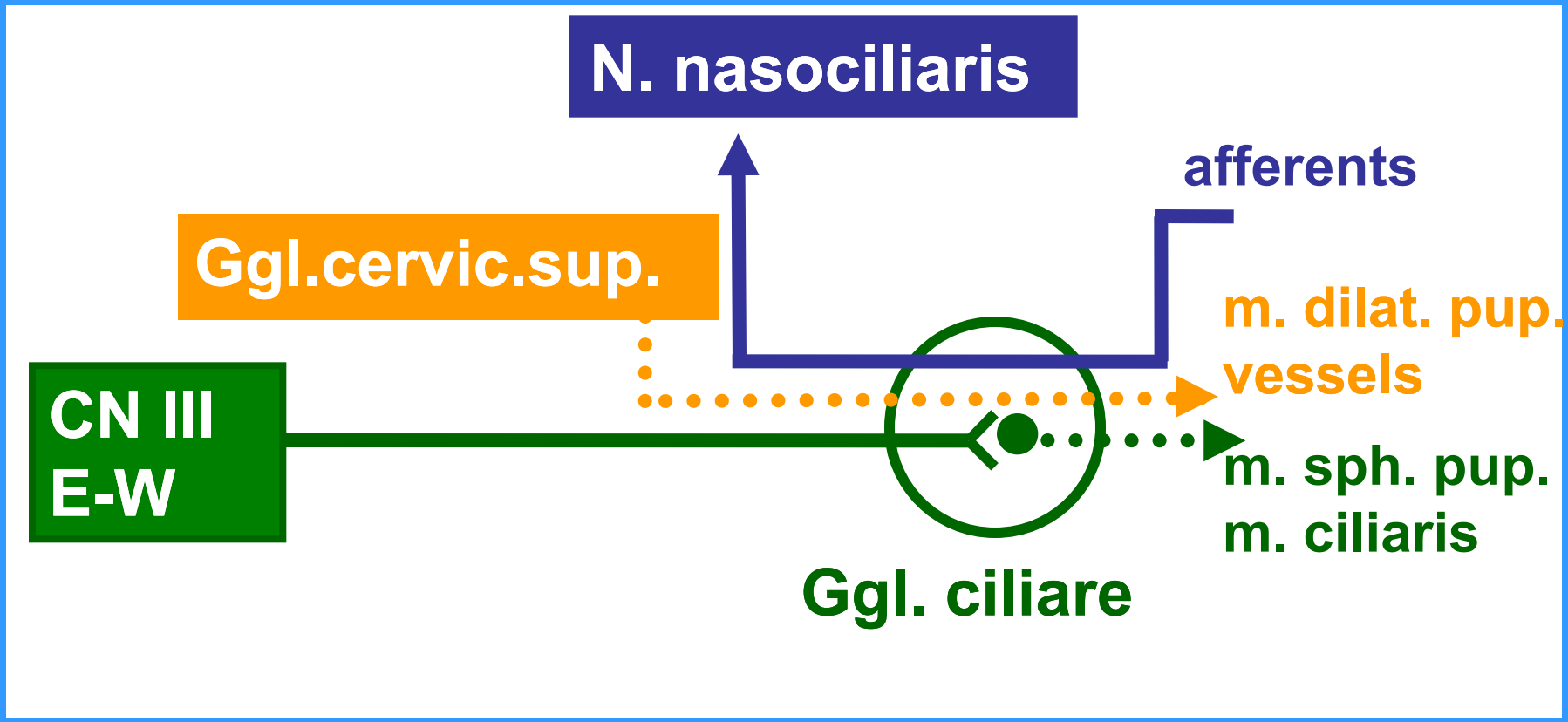

truncus sympathicus dexter
ductus thoracicus
nervus splanchnicus major a minor dexter
nervus phrenicus dexter
arteriae phrenicae inferiores a plexus
nervus splanchnicus major a minor dexter
plexus suprarenalis dexter
ganglion aorticonenale dextrum
nervus splanchnicus minor dexter
arteria renalis dextra et plexus
truncus sympathicus dexter
ramus communicans albus et griseus
cisterna chyli
ramus communicans griseus
Ganglion lumbale
Nn. splanchnici lumbales
ureter dexter a plexus
arteria testicularis (ovarica) dextra et plexus
IV.nervus splanchnicus lumbalis
Ganglion sacrale
rami communicantes grisei
truncus vagalis anterior
truncus vagalis posterior
arteria gastrica sinistra a plexus
ganglia coeliaca
nervus splanchnicus major sinister
nervus splanchnicus minor sinister
arteria et plexus lienalis
arteria hepatica communis et plexus
ganglion mesentericum superius et plexus
ganglion aorticorenale sinistrum
truncus sympathicus sinister
plexus aorticus (intermesentericus)
ganglion mesentericum inferius
arteria colica sinistra a plexus
arteria mesenterica inferior a plexus
arteria iliaca communis sinistra a plexus
arteria et plexus rectalis superior
plexus hypogastricus superior
arteria iliaca interna et externa a plexus
nervus hypogastricus dexter et sinister směřující k plexus hypogastricus (pelvicus) inferior
plexus sacralis sinister
nervi splanchnici pelvici



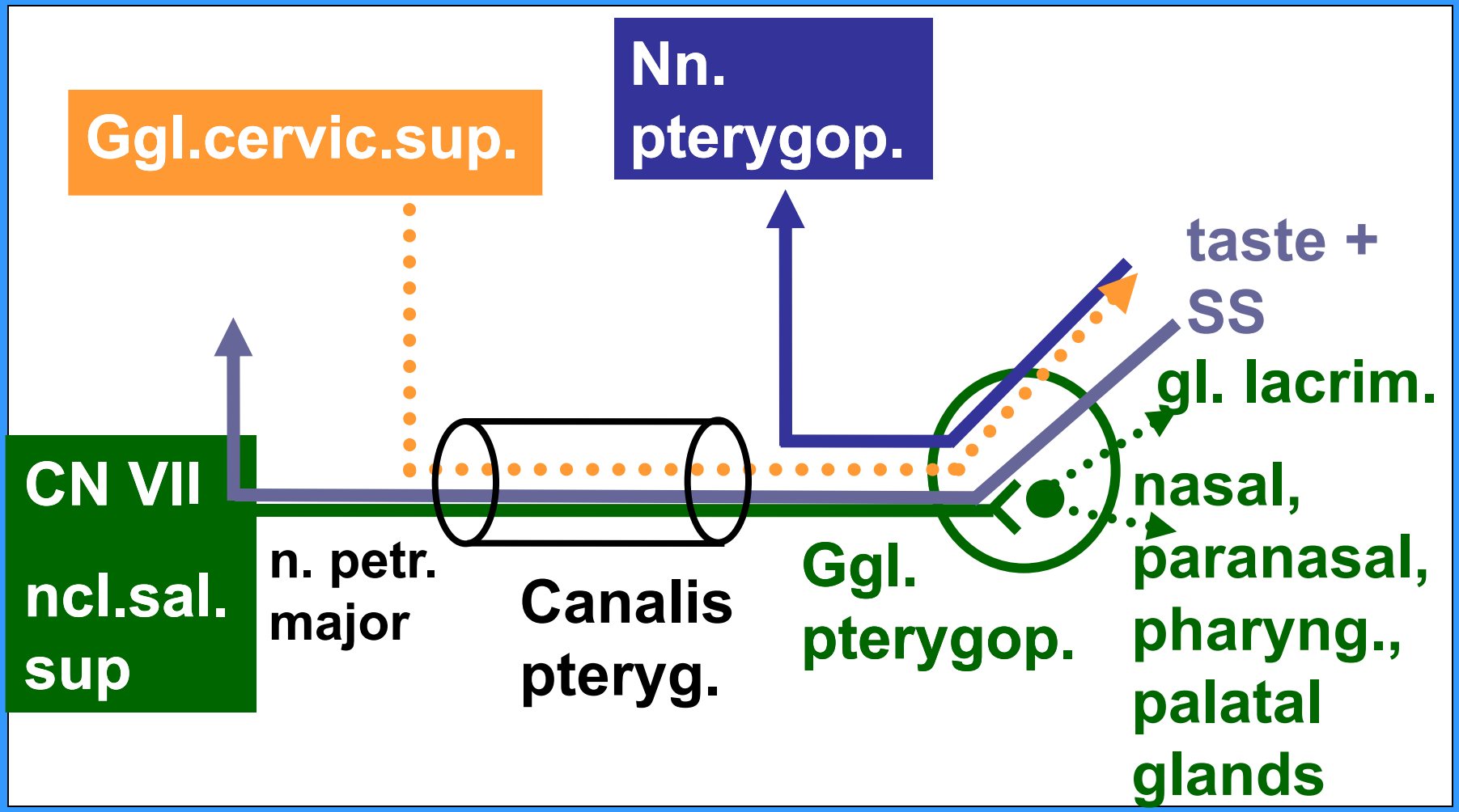
Prevertebral ganglia

Coeliacum
Mesentericum sup.
Aorticorenale
Mesentericum inf.

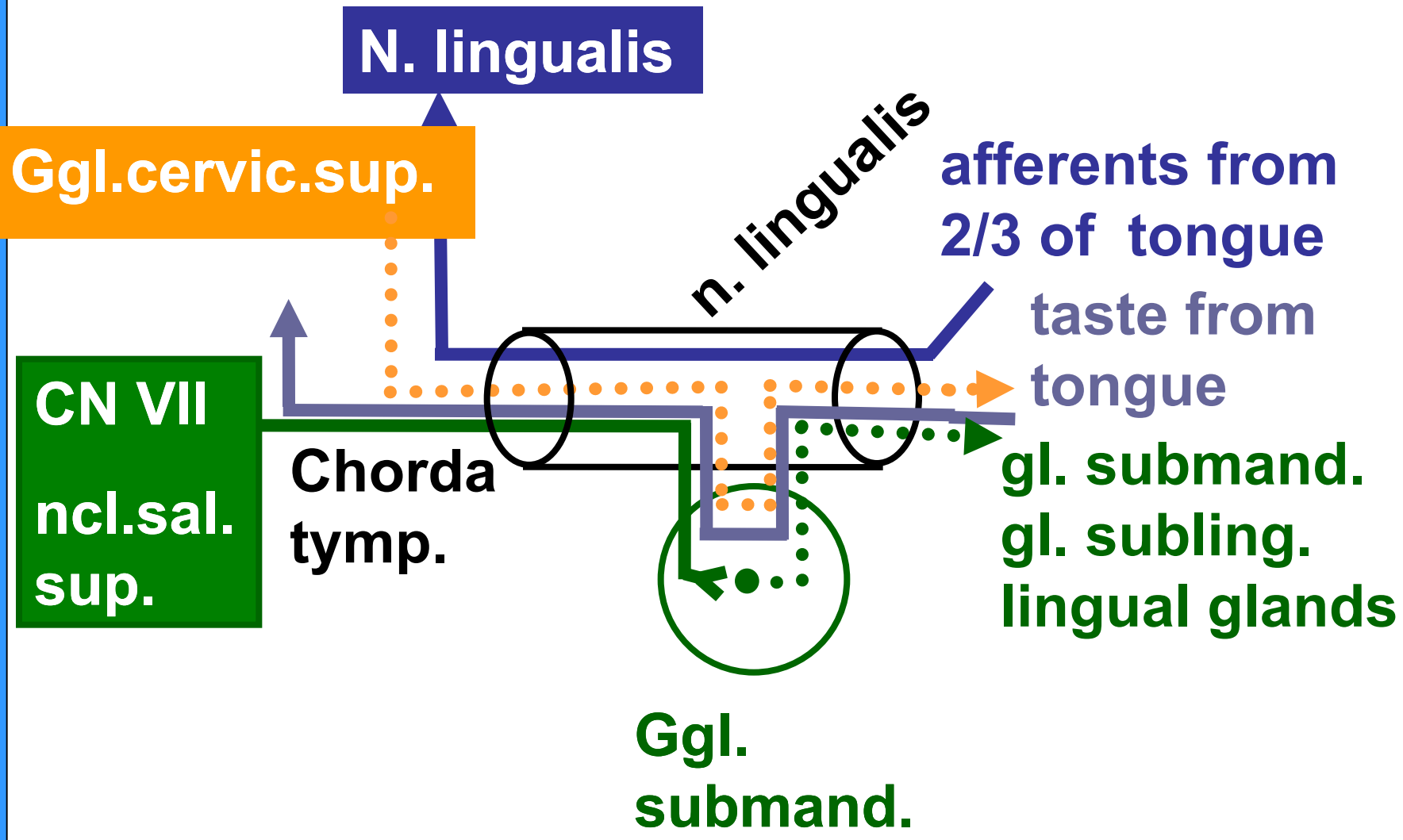
Ggl. ciliare


N. nasociliaris
afferents
Ggl.cervic.sup.
m. dilat. pup.
vessels
CN III
E-W
m. sph. pup.
m. ciliaris
Ggl. ciliare

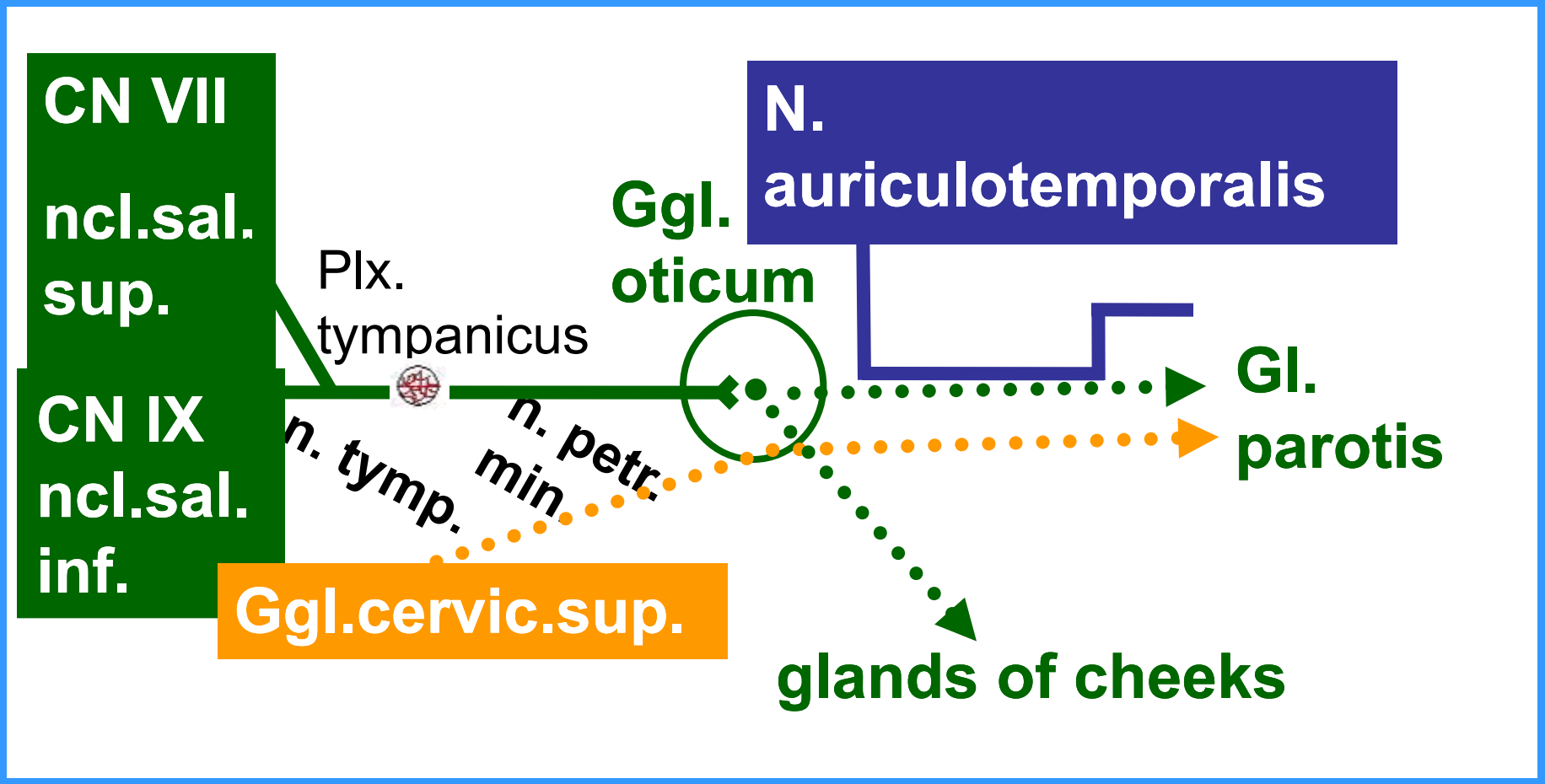
Ggl. pterygopalat.



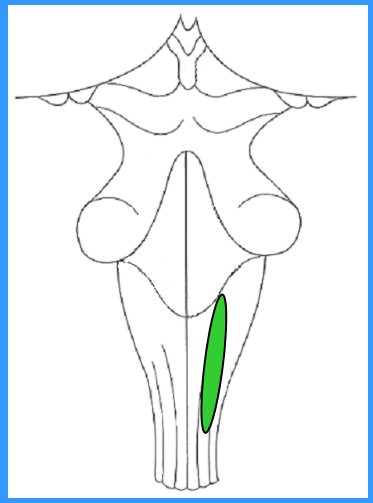
Ggl. submand.


N. lingualis
Ggl.cervic.sup.
n. lingualis
afferents from
2/3 of tongue
taste from
tongue
CN VII
ncl.sal.
sup.
Chorda
tymp.
gl. submand.
gl. subling.
lingual glands
Ggl.
submand.

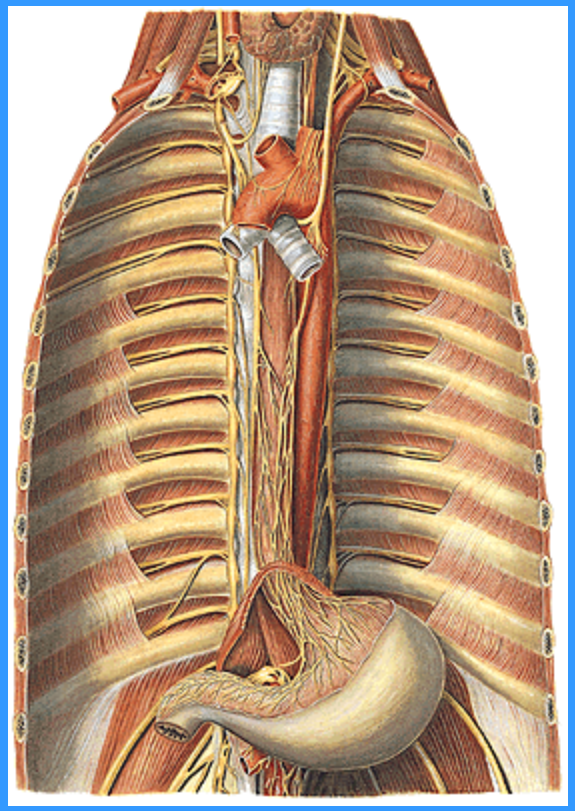
Ggl. oticum


CN VII
ncl.sal. sup.
CN IX
ncl.sal. inf.
Plx. tympanicus
n. tymp.
n. petr. min
Ggl. oticum
N. auriculotemporalis
Gl. parotis
Ggl.cervic.sup.
glands of cheeks

Ncl. p. CN X



pharynx,oesophagus, trachea, bronchi, lungs, heart, stomach, liver, kidneys, intestine to flex. coli sin., genital glands



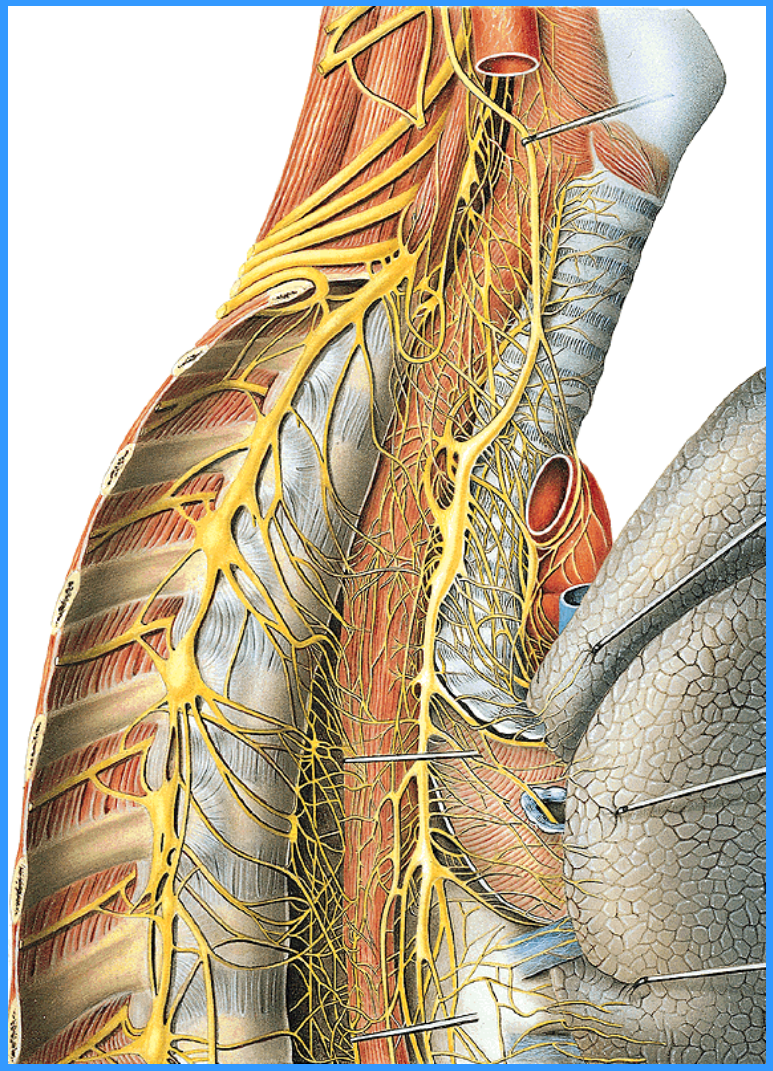
Sacral parasympathetic s.

Ncl. intermediolat.

pregangl. f. - nn. splanch. pelvici to plx. hypog. sup. et inf. - ganglia pelvica
> postgangl. f. - effectors

intestine from flexura coli sin.
organs of pelvis (exept genital glands)
erectile bodies of penis and clitoris

ANS innervates organs of thorax, abdomen and pelvis through **mixed autonomic plexuses**

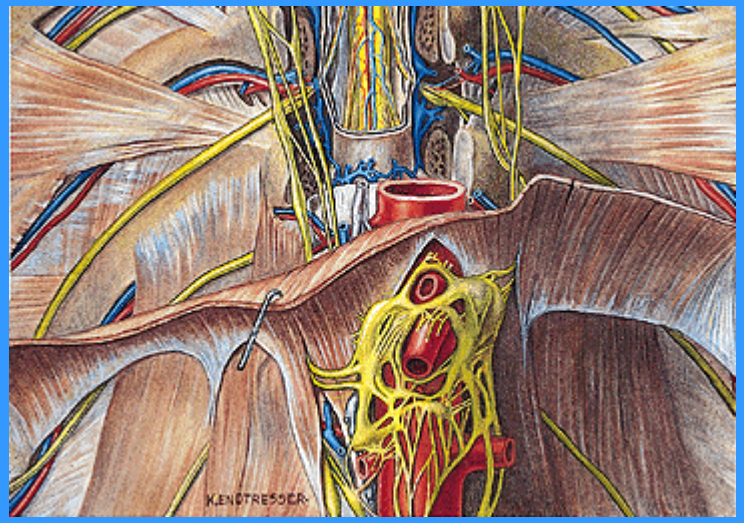


Thorax

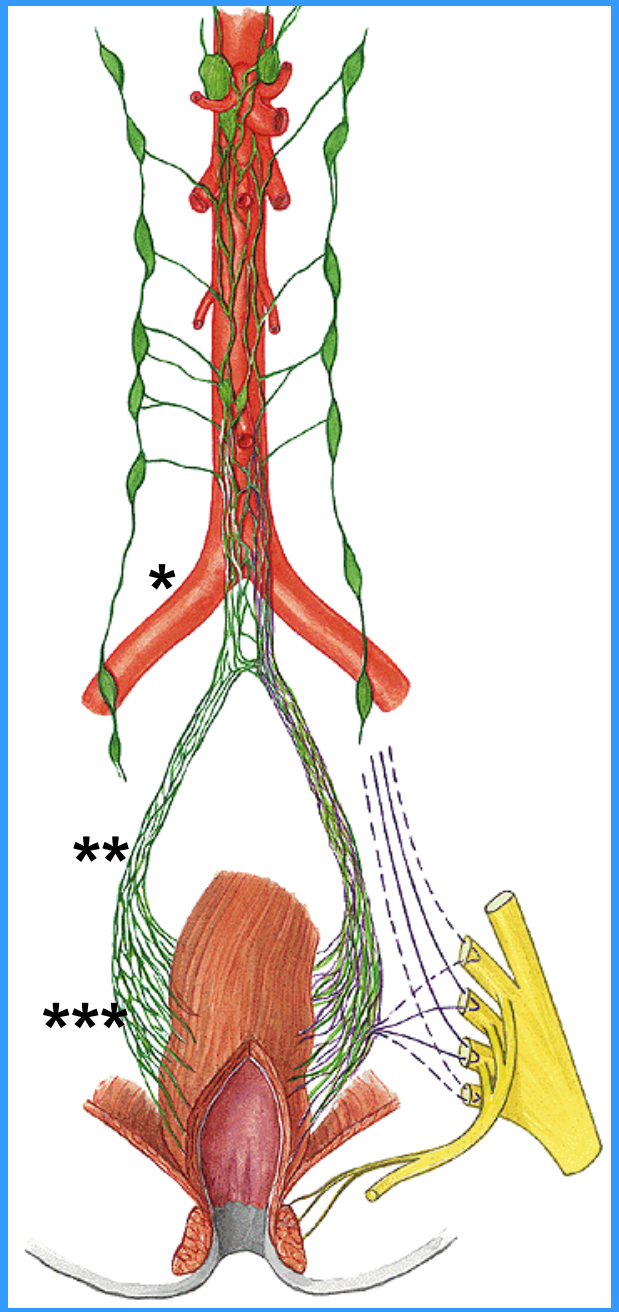
Plx. card. superf. et prof.
Plx. aorticus thoracicus
Plx. pulmonalis
Plx. eosophageus

Abdomen

Plx. aorticus abdom.



coeliacus ... hepaticus, gastrici, lienalis, pancreaticus
renalis et suprarenalis
testicularis / ovaricus
uretericus
mesent. sup. (n. vagus)
mesent. inf. (sacral parasymp.)

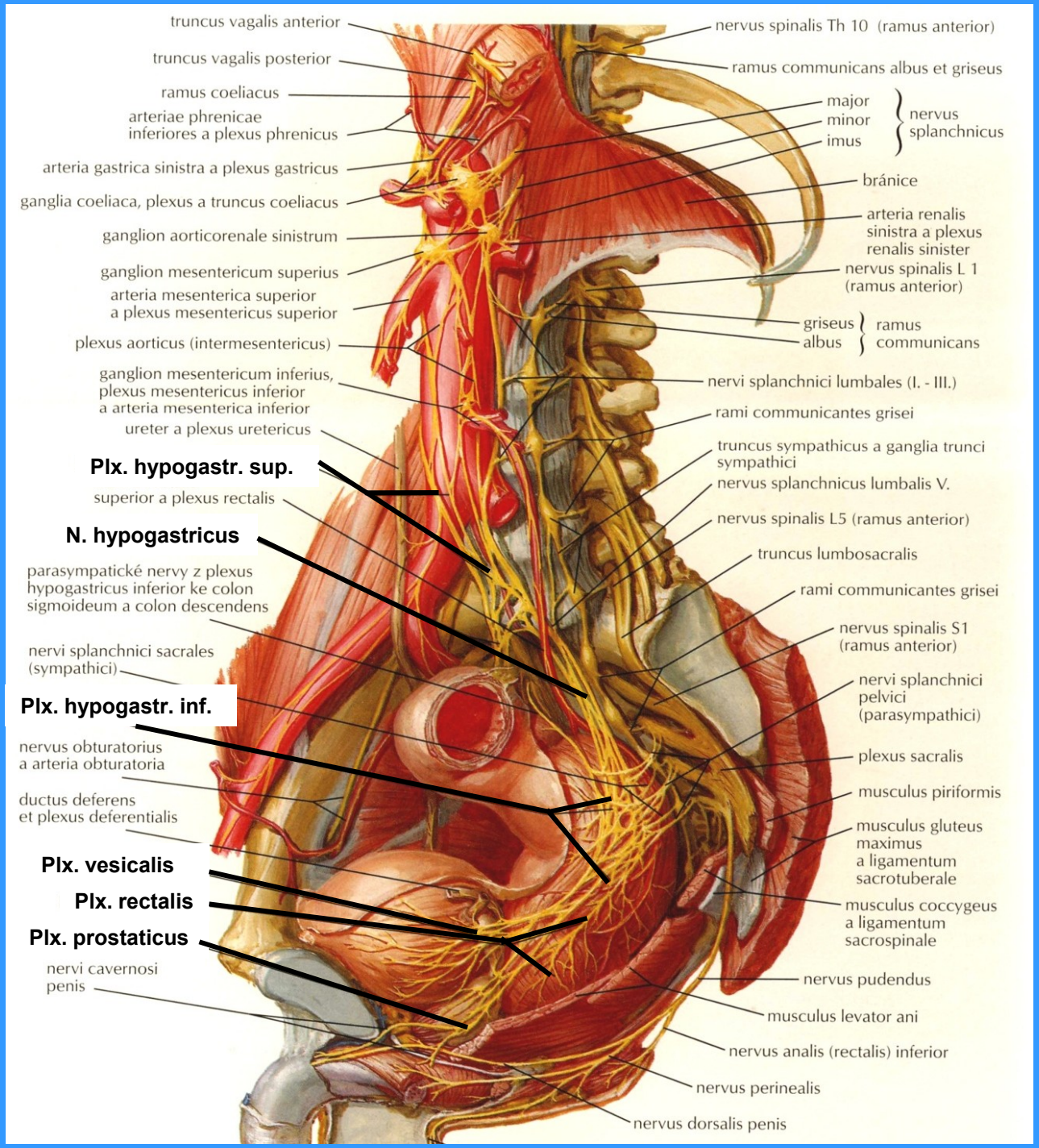


Pelvis

* Plx. hypogastr. sup.
** N. hypogastr. dx. et sin.
*** Plx. hypogastr. inf.

> plexus:

rectales medii et inferiores
vesicales
prostaticus
deferentialis
uterovaginalis
cavernosi penis / clitoridis

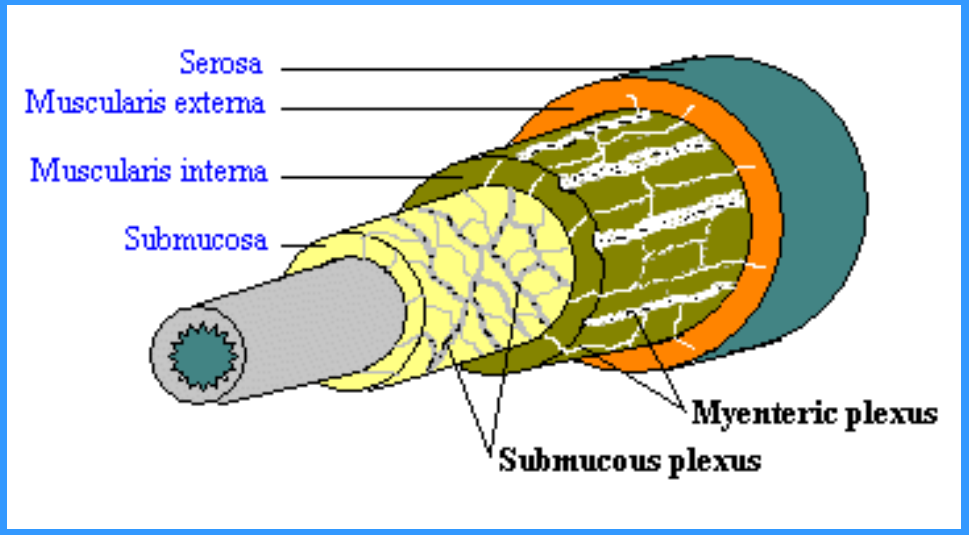

truncus vagalis anterior
truncus vagalis posterior
ramus coeliacus
arteriae phrenicae inferiores a plexus phrenicus
arteria gastrica sinistra a plexus gastricus
ganglia coeliaca, plexus a truncus coeliacus
ganglion aorticorenale sinistrum
ganglion mesentericum superius
arteria mesenterica superior a plexus mesentericus superior
plexus aorticus (intermesentericus)
ganglion mesentericum inferius, plexus mesentericus inferior a arteria mesenterica inferior
ureter a plexus uretericus
Plx. hypogastr. sup.
superior a plexus rectalis
N. hypogastricus
parasympatické nervy z plexus hypogastricus inferior ke colon sigmoideum a colon descendens
nervi splanchnici sacrales (sympathici)
Plx. hypogastr. inf.
nervus obturatorius a arteria obturatoria
ductus deferens et plexus deferentialis
Plx. vesicalis
Plx. rectalis
Plx. prostaticus
nervi cavernosi penis
nervus spinalis Th 10 (ramus anterior)
ramus communicans albus et griseus
major
minor
imus
nervus splanchnicus
bránice
arteria renalis sinistra a plexus renalis sinister
nervus spinalis L 1 (ramus anterior)
griseus
albus
ramus communicans
nervi splanchnici lumbales (I. - III.)
rami communicantes grisei
truncus sympathicus a ganglia trunci sympathici
nervus splanchnicus lumbalis V.
nervus spinalis L5 (ramus anterior)
truncus lumbosacralis
rami communicantes grisei
nervus spinalis S1 (ramus anterior)
nervi splanchnici pelvici (parasympathici)
plexus sacralis
musculus piriformis
musculus gluteus maximus a ligamentum sacrotuberale
musculus coccygeus a ligamentum sacrospinale
nervus pudendus
musculus levator ani
nervus analis (rectalis) inferior
nervus perinealis
nervus dorsalis penis

Enteric system

neurons and interneurons in the wall of digestive tube

Plx. myentericus
Auerbachi

Plx. submucosus
Meissneri

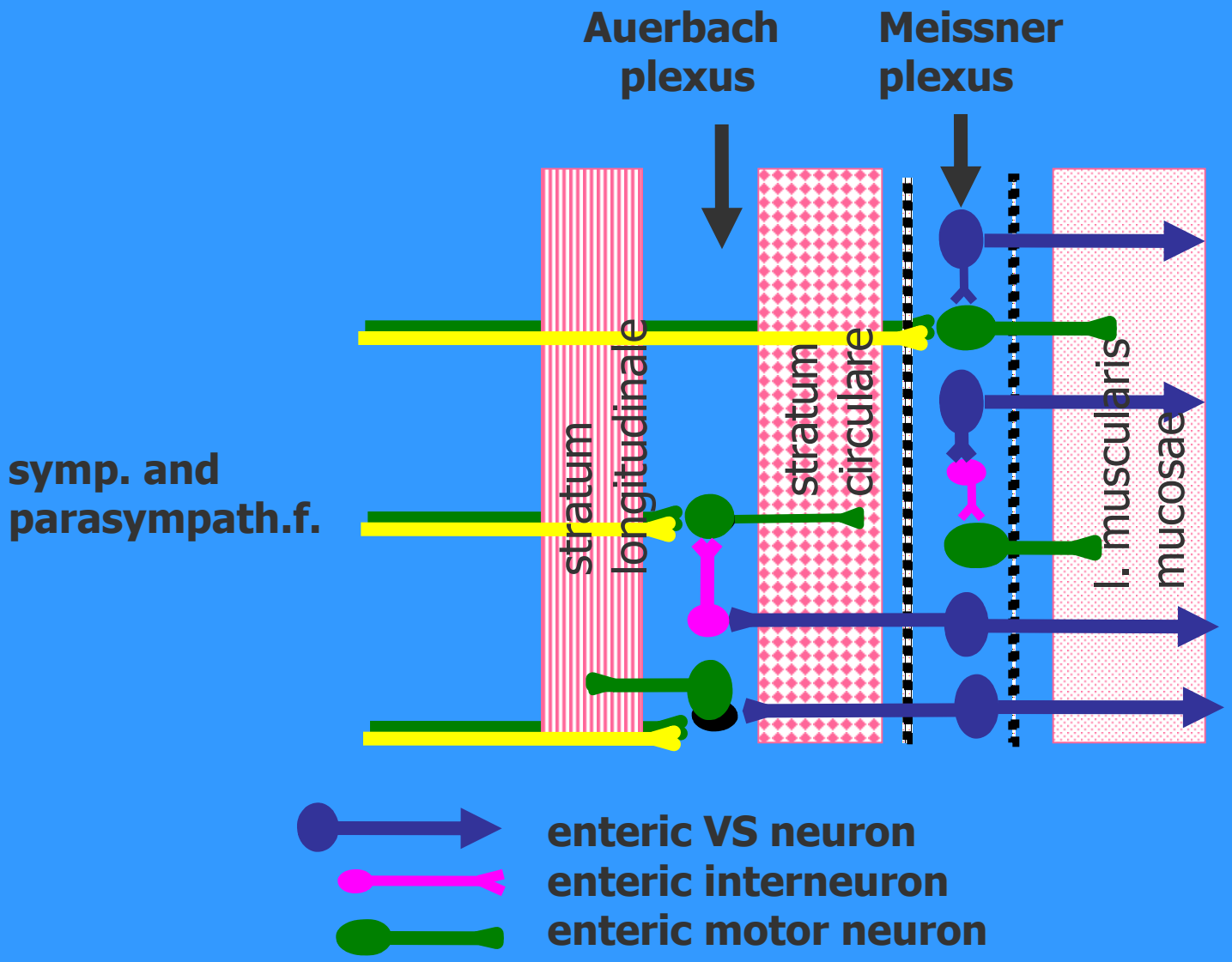


plexuses contain small ganglia

ganglia receive signals:
from receptors of GIT
from CNS via symp. a parasymp. nerves

through interneurons

control activity of GIT through stimulation or inhibition of motoneurons of enteric system
= controls tonus and motions of digestive tube and secretion of glands


Auerbach plexus
Meissner plexus
symp. and parasympath.f.
stratum longitudinale
stratum circulare
l. muscularis mucosae
enteric VS neuron
enteric interneuron
enteric motor neuron

Illustrations and photographs were copied from:
Atlas der Anatomie des Menschen/Sobotta. Putz,R., und Pabst,R. 20. Auflage. München: Urban & Schwarzenberg, 1993
Netter: Interactive Atlas of Human Anatomy. Windows Version 2.0