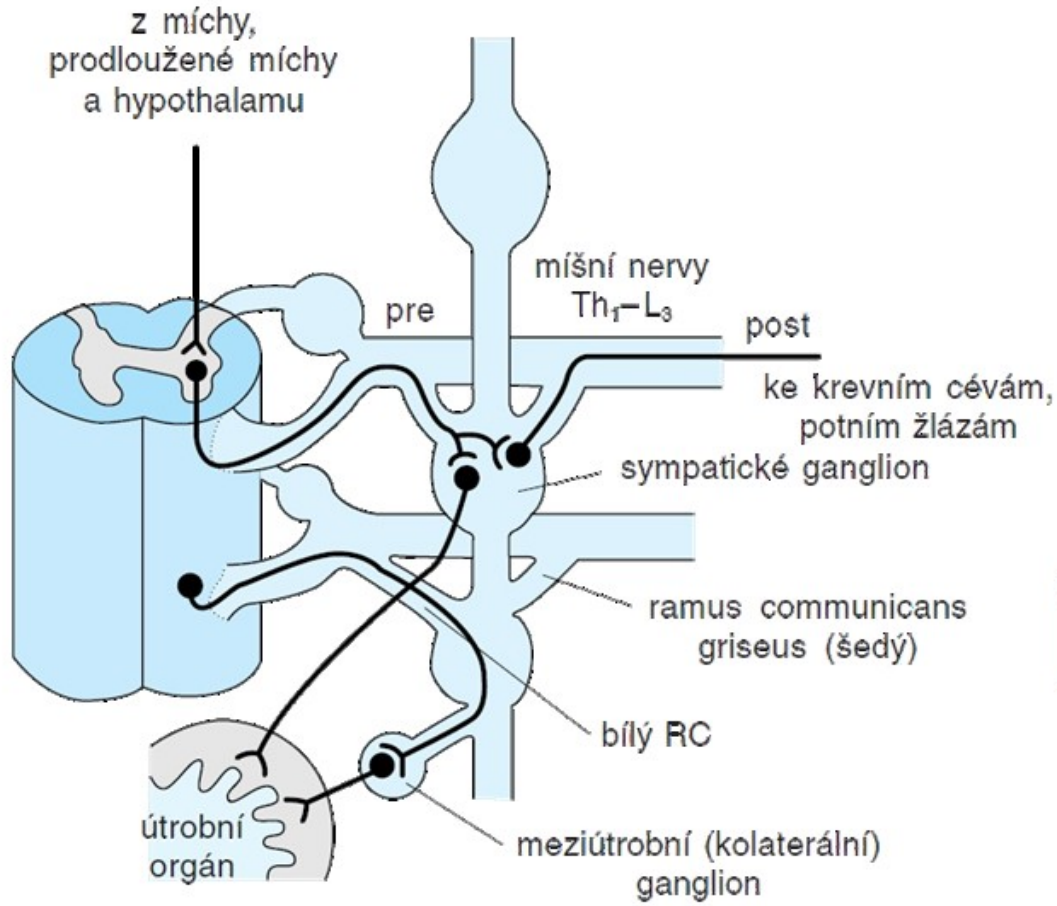


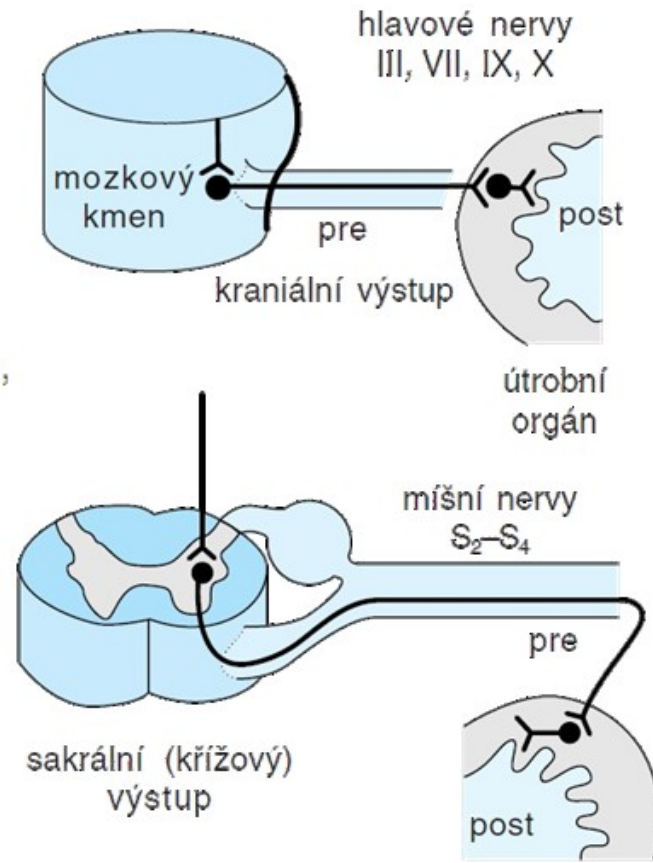
MUNI
MED

Autonomní nervový systém

ANS



SYMPATICKÁ ČÁST



PARASYMPATICKÁ ČÁST

ANS inervuje:

- žlázy s vnější sekrecí (slinné, potní, slzné, různé sliznice produkující hlen)
- hladkou svalovinu
- srdeční svalovinu
- srdce a krevní cévy pro kontrolu krevního tlaku a průtoku
- průdušky v plicích pro řešení kyslíkové náročnosti organismu

ANS reguluje:

- trávicí a metabolické funkce jater, GIT, pankreatu
- funkce ledvin, močového měchýře, tlustého střeva, rekta
- ANS je nezbytný pro sexuální reakce genitálií a reprodukčních orgánů
- interaguje s imunitním systémem těla

Ve většině případů jsou úrovně aktivity obou částí ANS reciproční=vzájemné

- když je jedna vysoká, druhá má tendenci být nízká a naopak.

autonomní NS versus somatický (motorický) NS

Comparison of Somatic Motor and Autonomic Divisions

	SOMATIC MOTOR	AUTONOMIC
Number of neurons in efferent path	1	2
Neurotransmitter/receptor at neuron-target synapse	ACh/nicotinic	ACh/muscarinic or NE/ α - or β -adrenergic
Target tissue	Skeletal muscle	Smooth and cardiac muscle; some endocrine and exocrine glands; some adipose tissue
Neurotransmitter released from	Axon terminals	Varicosities and axon terminals
Effects on target tissue	Excitatory only: muscle contracts	Excitatory or inhibitory
Peripheral components found outside the CNS	Axons only	Preganglionic axons, ganglia, postganglionic neurons
Summary of function	Posture and movement	Visceral function, including movement in internal organs and secretion; control of metabolism

Autonomní nervový systém

AUTONOMIC PATHWAYS

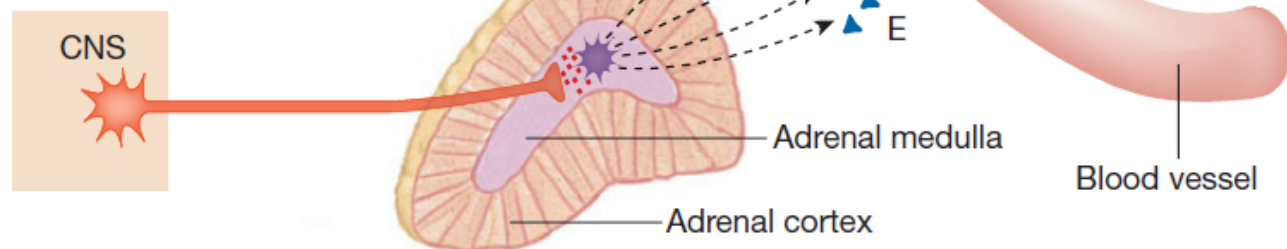
(a) Parasympathetic Pathway



(b) Sympathetic Pathway



(c) Adrenal Sympathetic Pathway



Autonomní nervový systém

Pregangliová vlákna

SNS, PNS

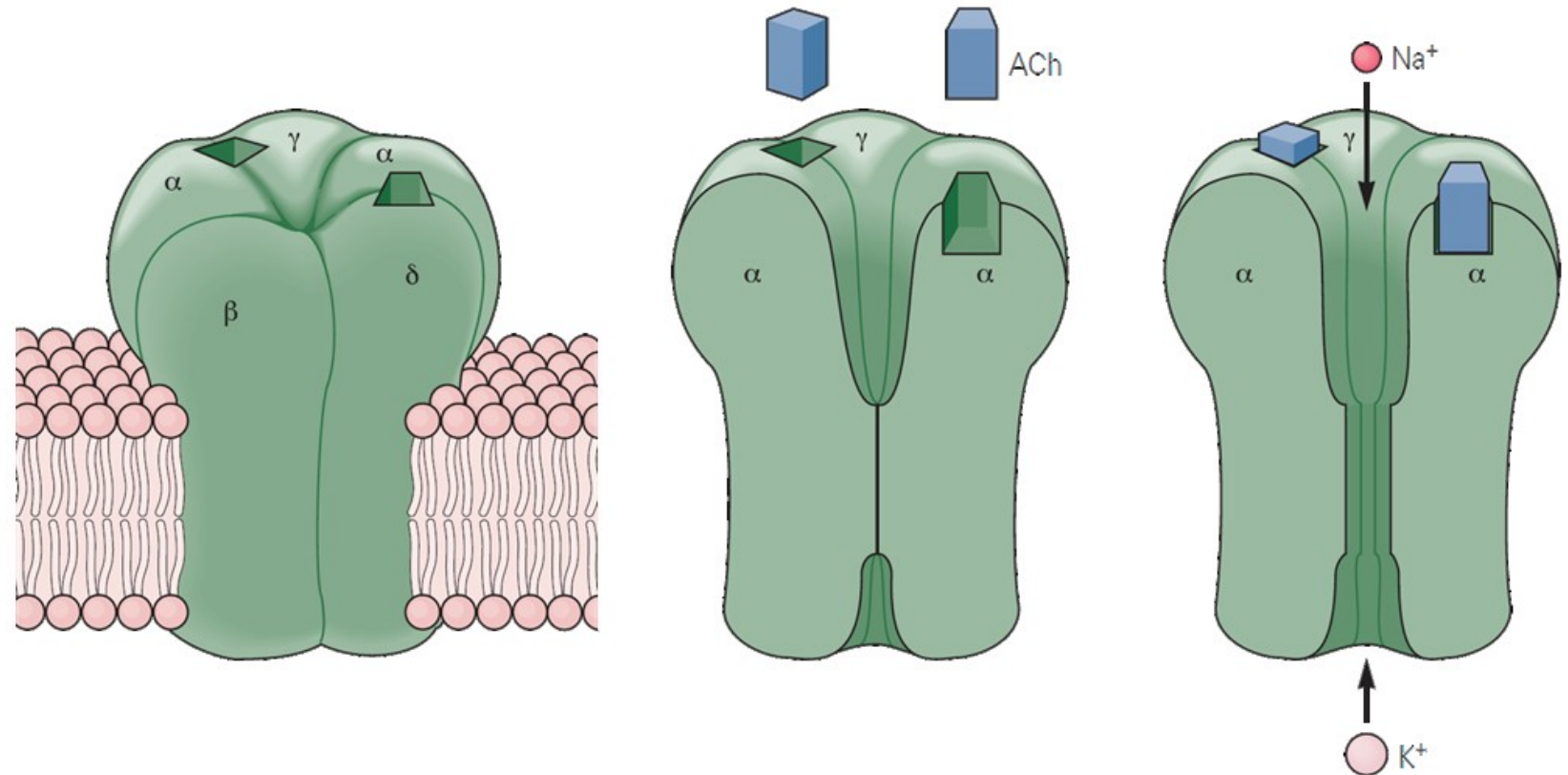
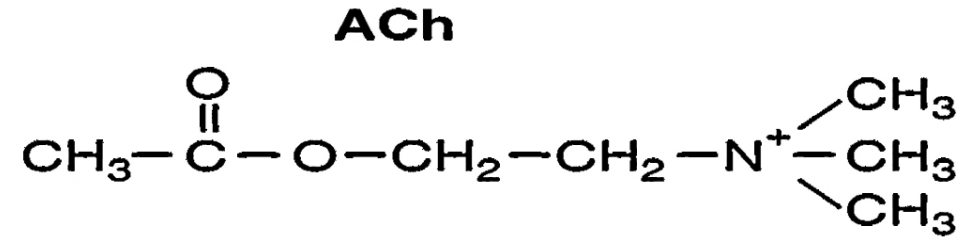
Nikotinový recepto

N_N typ a N_M typ

Excitační typ receptoru

Ionotropní receptor

(po navázání se otevírá iontový kanál)



Autonomní nervový systém

Postgangliová vlákna

PNS

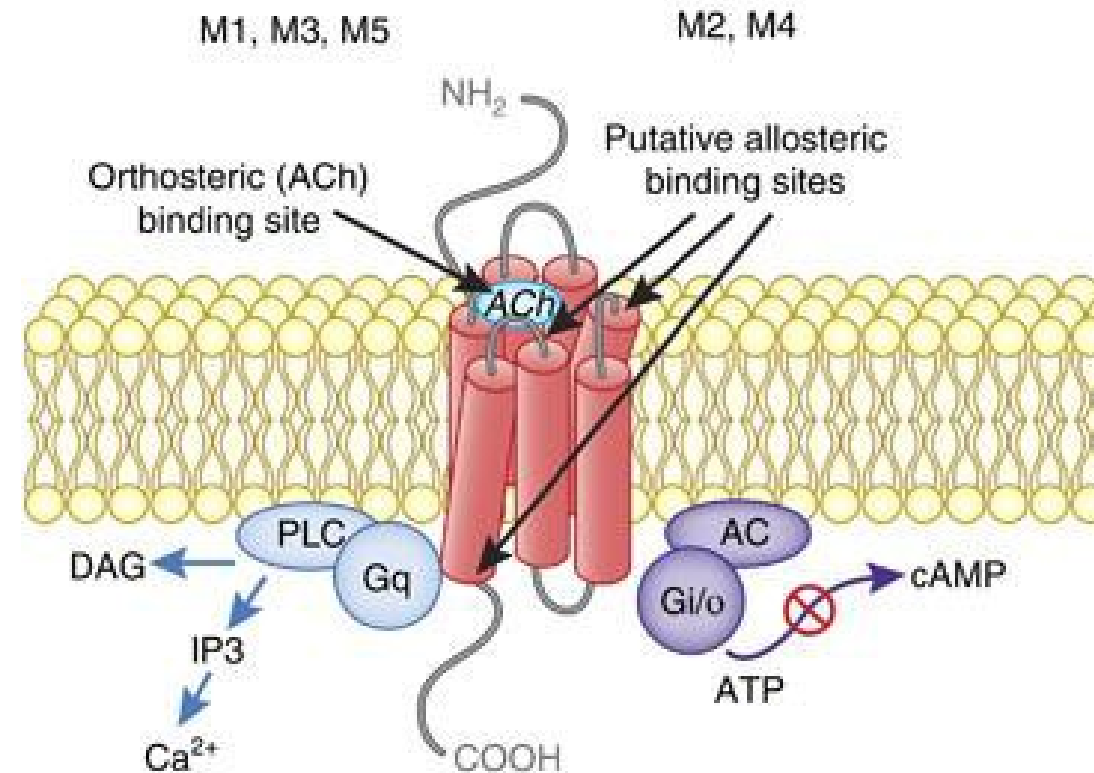
Muscarinový receptor

Spřažený s G proteinem

Excitací efekt mají: M_1 , M_3 , M_5

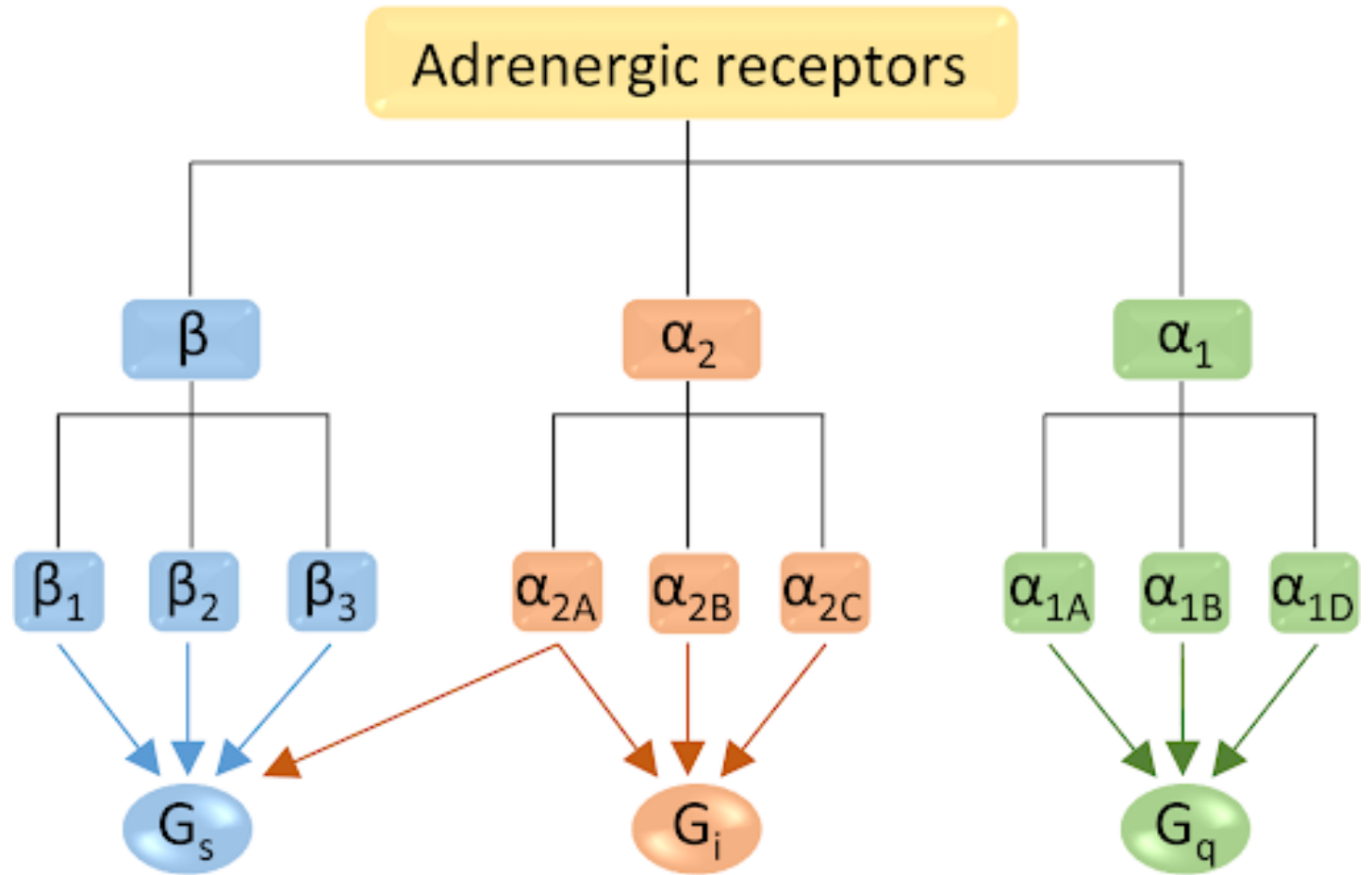
Inhibiční efekt: M_2 , M_4

Metabotropní receptor

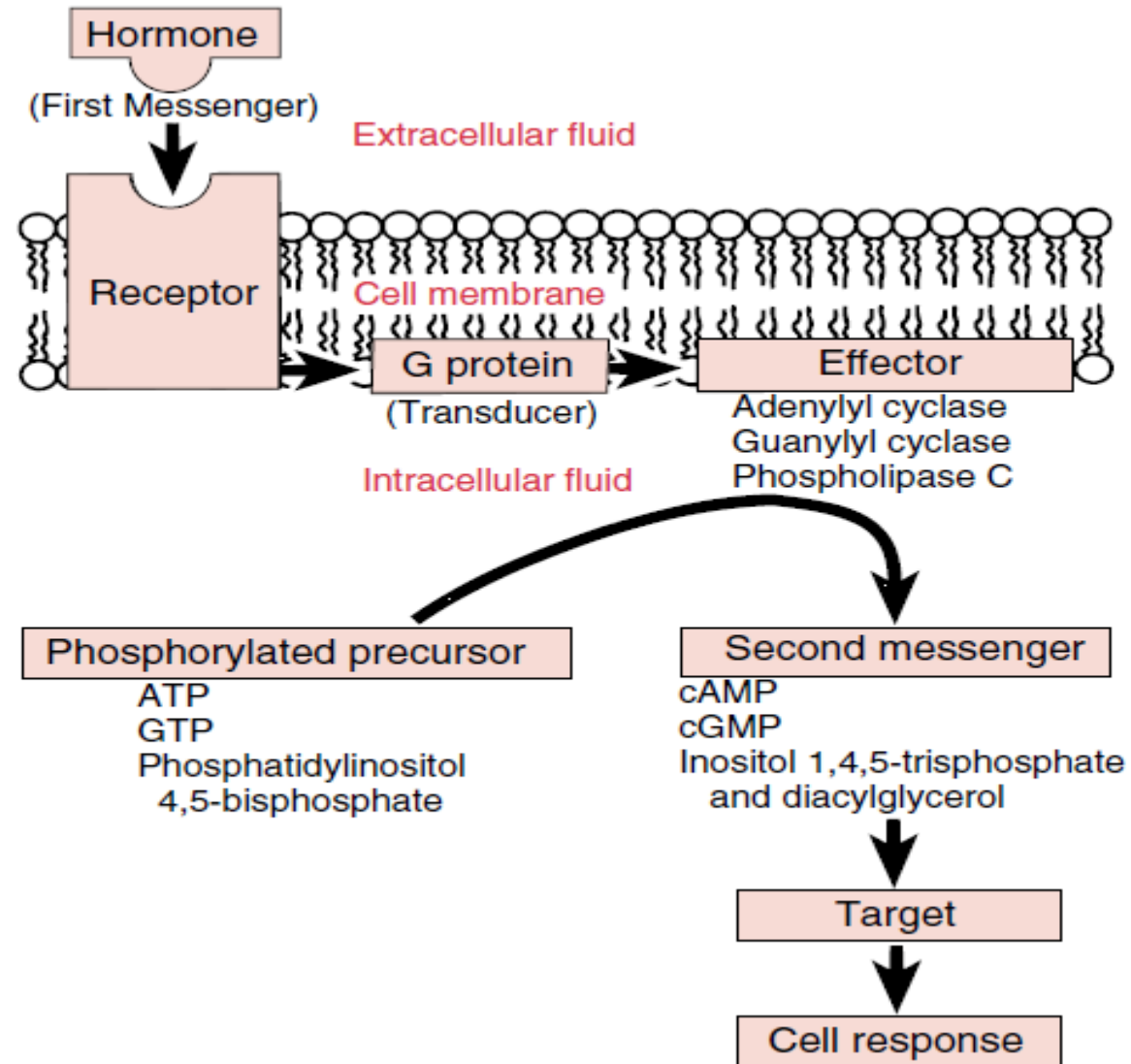


Autonomní nervový systém

- Postgangliová vlákna
- SNS
- *Adrenergní receptor*
 - Spřažený s G-proteinem



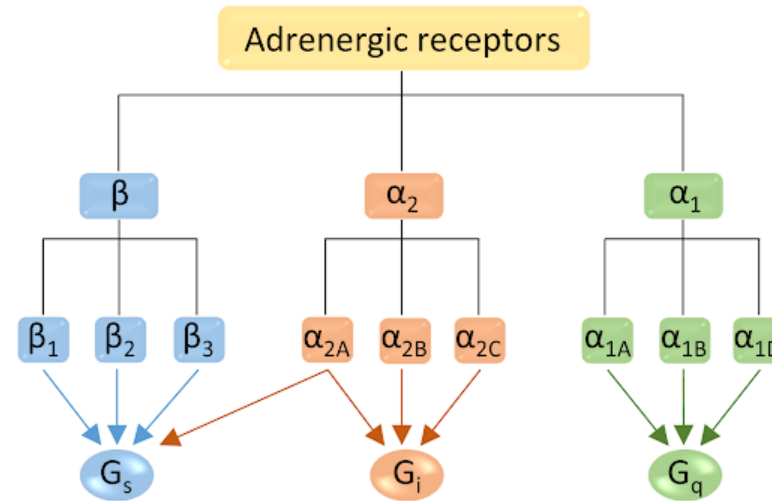
System druhéh poslů



Autonomní nervový systém

Adrenergní receptor

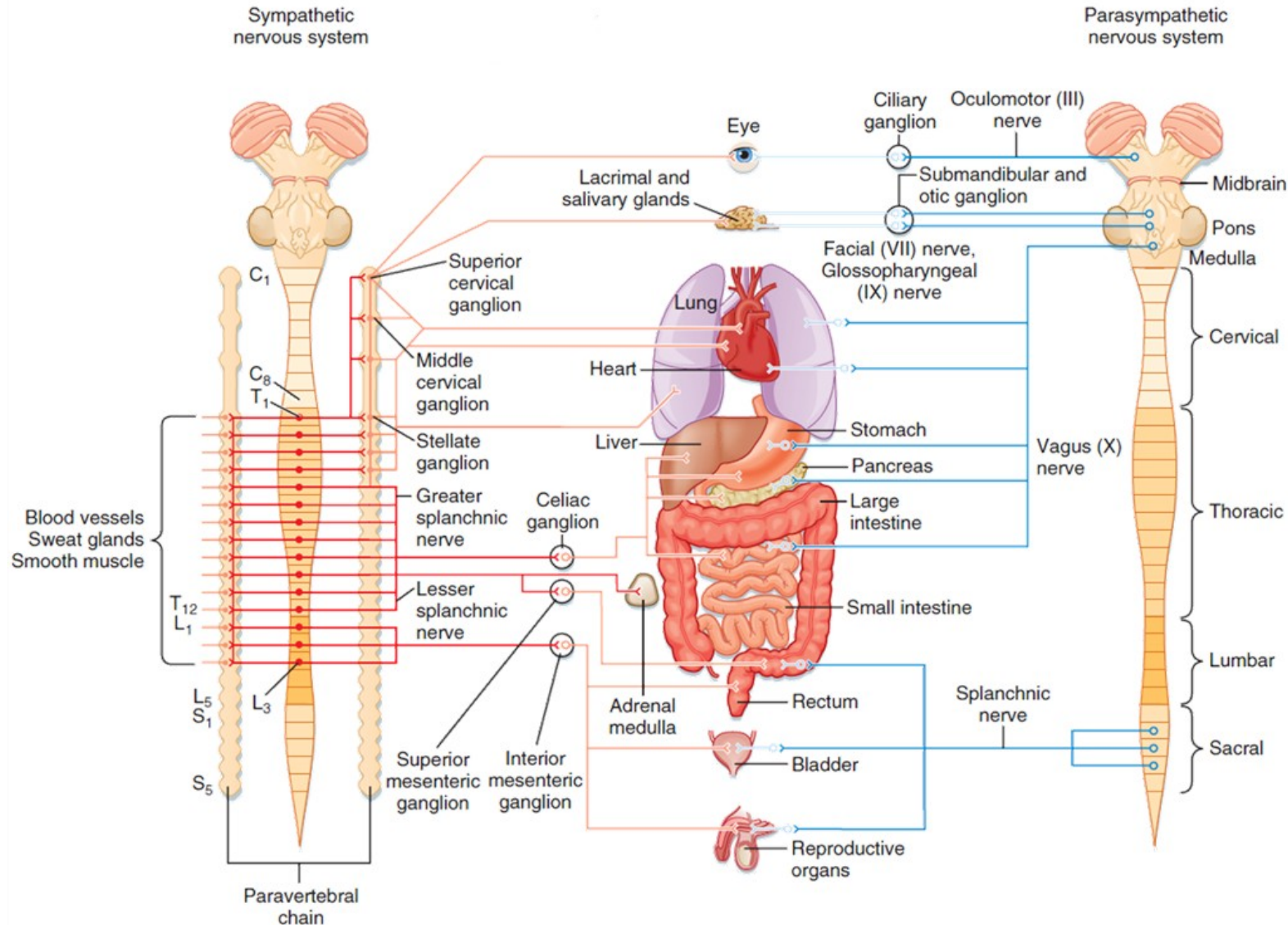
- Spřažený s G-proteinem
- Typ α – Excitační receptory
- Typ β – Inhibiční receptory



Receptor Type	Primary Mechanism of Action	Examples of Tissue Distribution	Examples of Action
α_1	\uparrow IP3 and Ca^{++} , DAG	Sympathetic postsynaptic nerve terminals	Increase vascular smooth muscle contraction
α_2	\downarrow cAMP	Sympathetic presynaptic nerve terminals, beta cell of pancreatic islets	Inhibit norepinephrine release, inhibit insulin release
β_1	\uparrow cAMP	Heart	Increase cardiac output
β_2	\uparrow cAMP	Liver; smooth muscle of vasculature, bronchioles, and uterus	Increase hepatic glucose output; decrease contraction of blood vessels, bronchioles, and uterus
β_3	\uparrow cAMP	Liver, adipose tissue	Increase hepatic glucose output, increase lipolysis

Autonomní nervový systém

FIGHT OR FLIGHT
BOJUJ nebo UTEČ



REST OR DIGEST
ODPOČÍVEJ nebo
ZPRACOVÁVEJ POTRAVU

Sympathetic nervous system

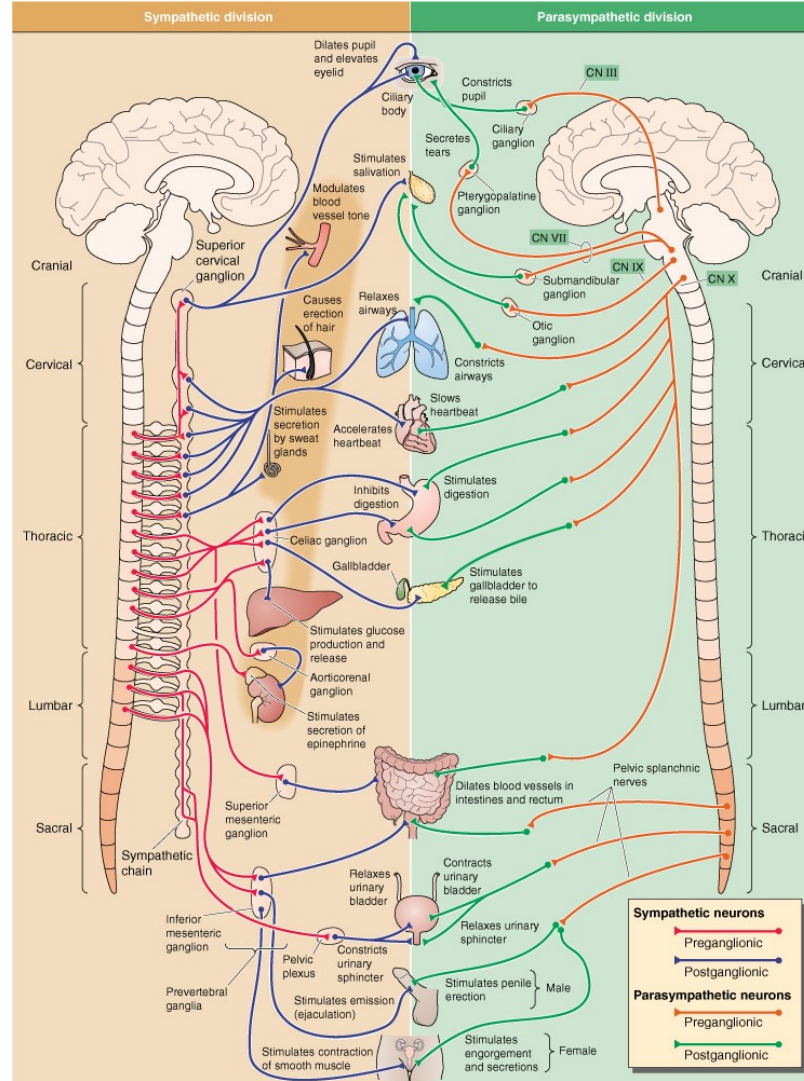
Fight or flight response

Energy/store consumption

Preganglionic neuron
– Spinal cord
-Thoraco - lumbar system

Ganglia *Paravertebral*
-Truncus sympathicus
- Majority
Prevertebral
-Plexus aorticus

Mostly diffuse effect



Parasympathetic nervous system

Rest and digest response

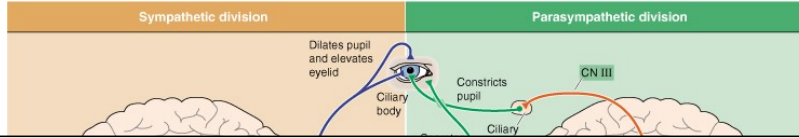
Energy conservation/en.
store production

Preganglionic neuron
– Brain stem and spinal cord
– cranio-sacral system

Ganglia
Close to target organs or intramurally

Mostly local effect

Sympathetic nervous system

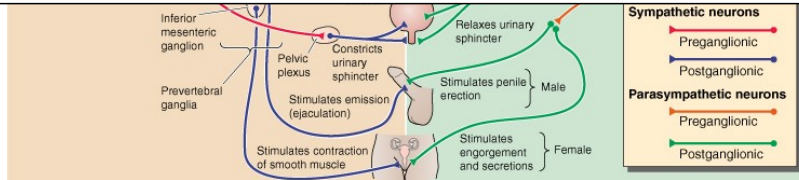


Parasympathetic nervous system

Fight or flight response
 Energy consumption
 Preganglionic neurons
 - Spinal
 - Thoracic system
 Ganglionic
 Paravertebral
 - Truncal
 - Majorly
 Prevertebral
 - Plexus aortic
 Mostly diffuse effect

System/function	Parasympathetic	Sympathetic
Cardiovascular	Decreased cardiac output and heart rate	Increased contraction and heart rate; increased cardiac output
Pulmonary	Bronchial constriction	Bronchial dilatation
Musculoskeletal	Muscular relaxation	Muscular contraction
Pupillary	Constriction	Dilatation
Urinary	Increased urinary output; sphincter relaxation	Decreased urinary output; sphincter contraction
Gastrointestinal	Increased motility of stomach and gastrointestinal tract; increased secretions	Decreased motility of stomach and gastrointestinal tract; decreased secretions
Glycogen to glucose conversion	No involvement	Increased
Adrenal gland	No involvement	Release epinephrine and norepinephrine

digestive
 Energy
 consumption
 Preganglionic
 neurons
 - Spinal
 - Thoracic
 system
 Ganglionic
 Paravertebral
 - Truncal
 - Majorly
 Prevertebral
 - Plexus aortic
 Mostly diffuse effect



intramurally
 Mostly local effect

Ovládání mozku ANS

Autonomic centers—brain stem and hypothalamus

1. Medulla

- Vasomotor center
- Respiratory center
- Swallowing, coughing, and vomiting centers

2. Pons

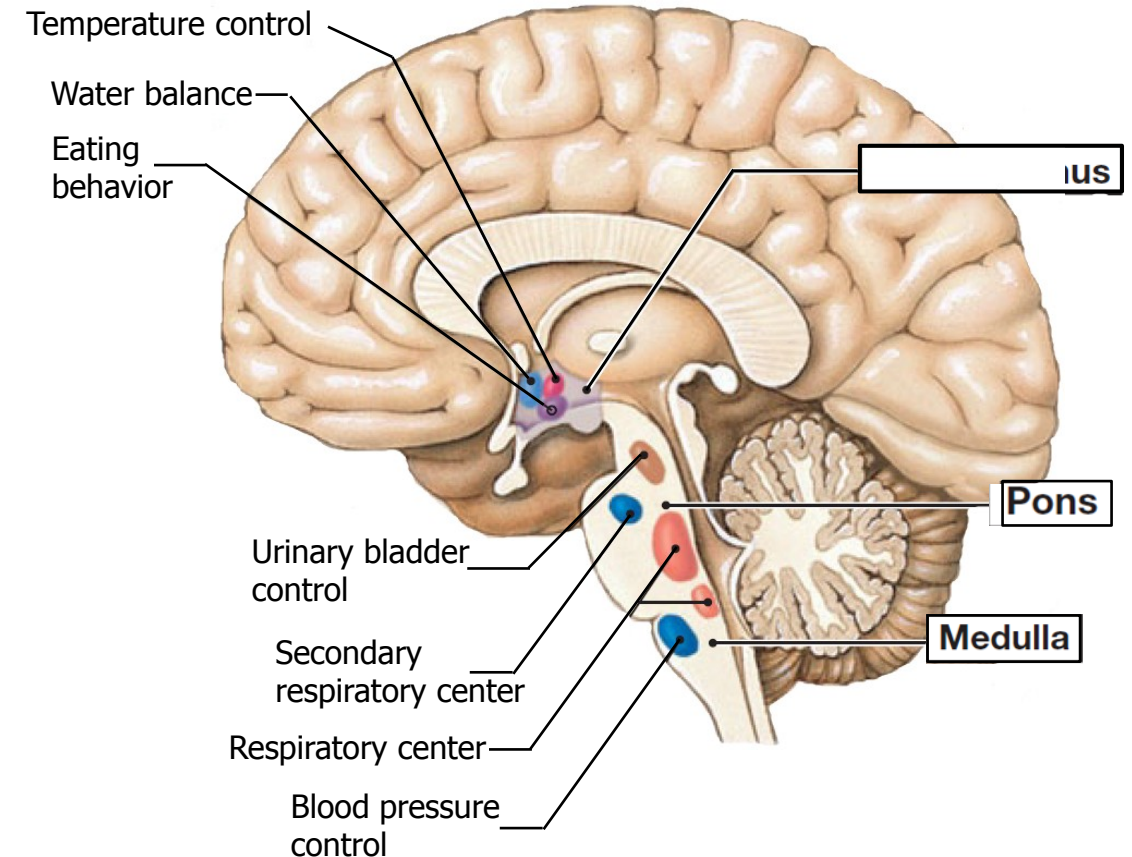
- Pneumotaxic center

3. Midbrain

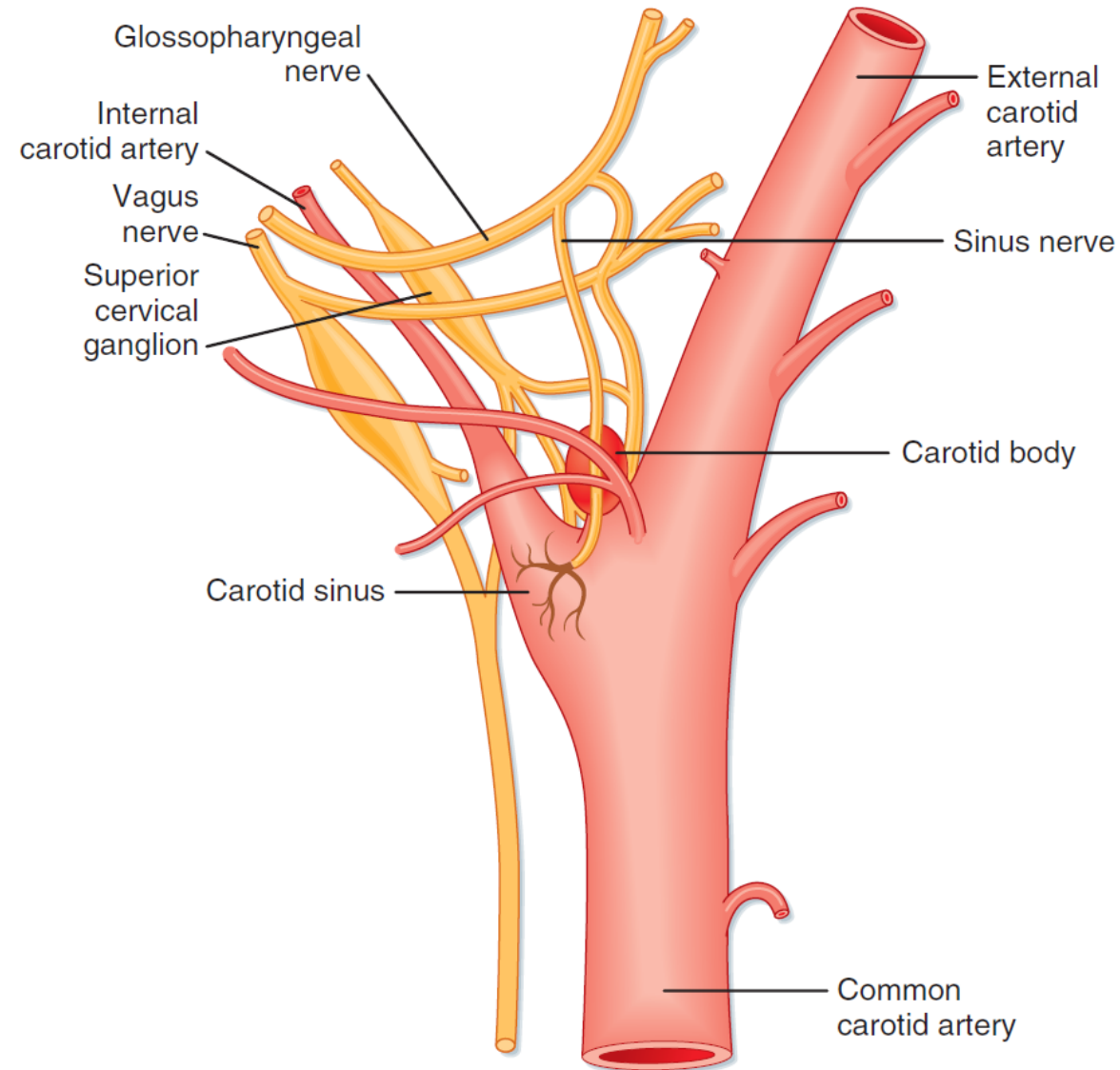
- Micturition center

4. Hypothalamus

- Temperature regulation center
- Thirst and food intake regulatory centers

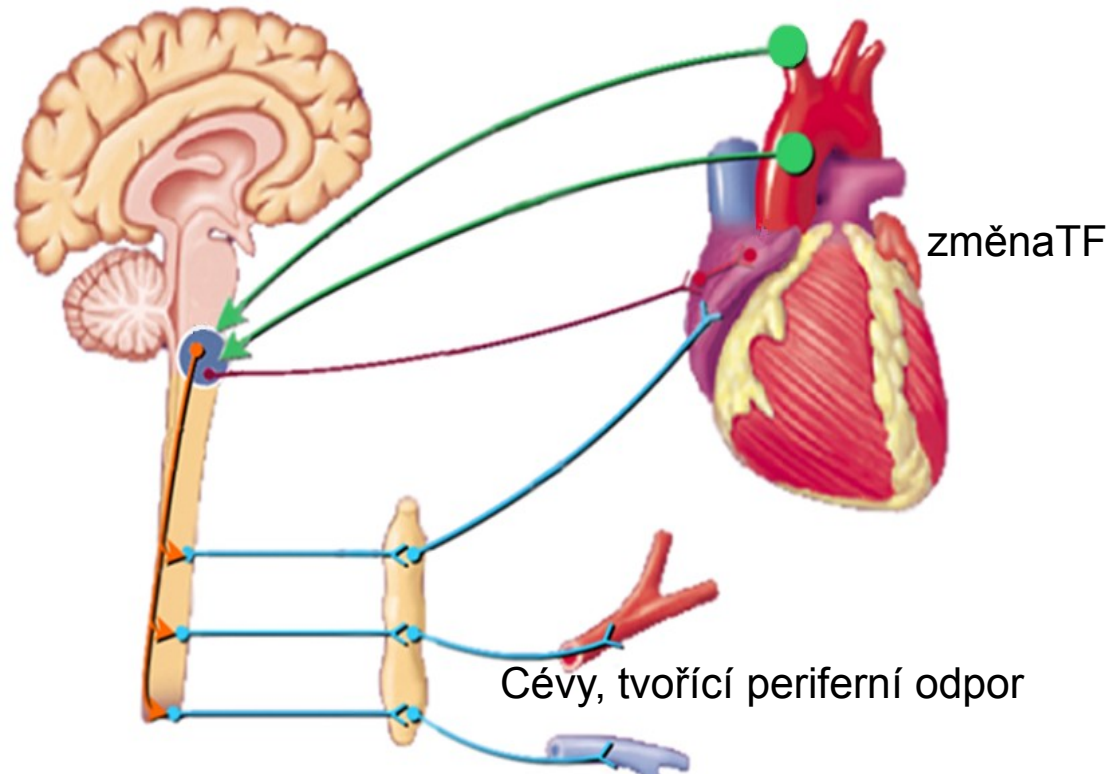


Baroreceptor vs. Chemoreceptor

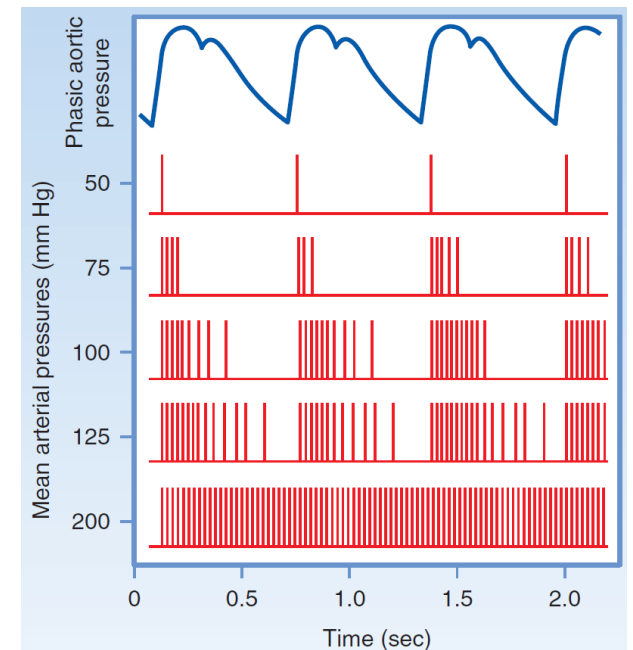


Baroreflex

- Aferentní dráha
- Parasympatická dráha
- Sympatická dráha



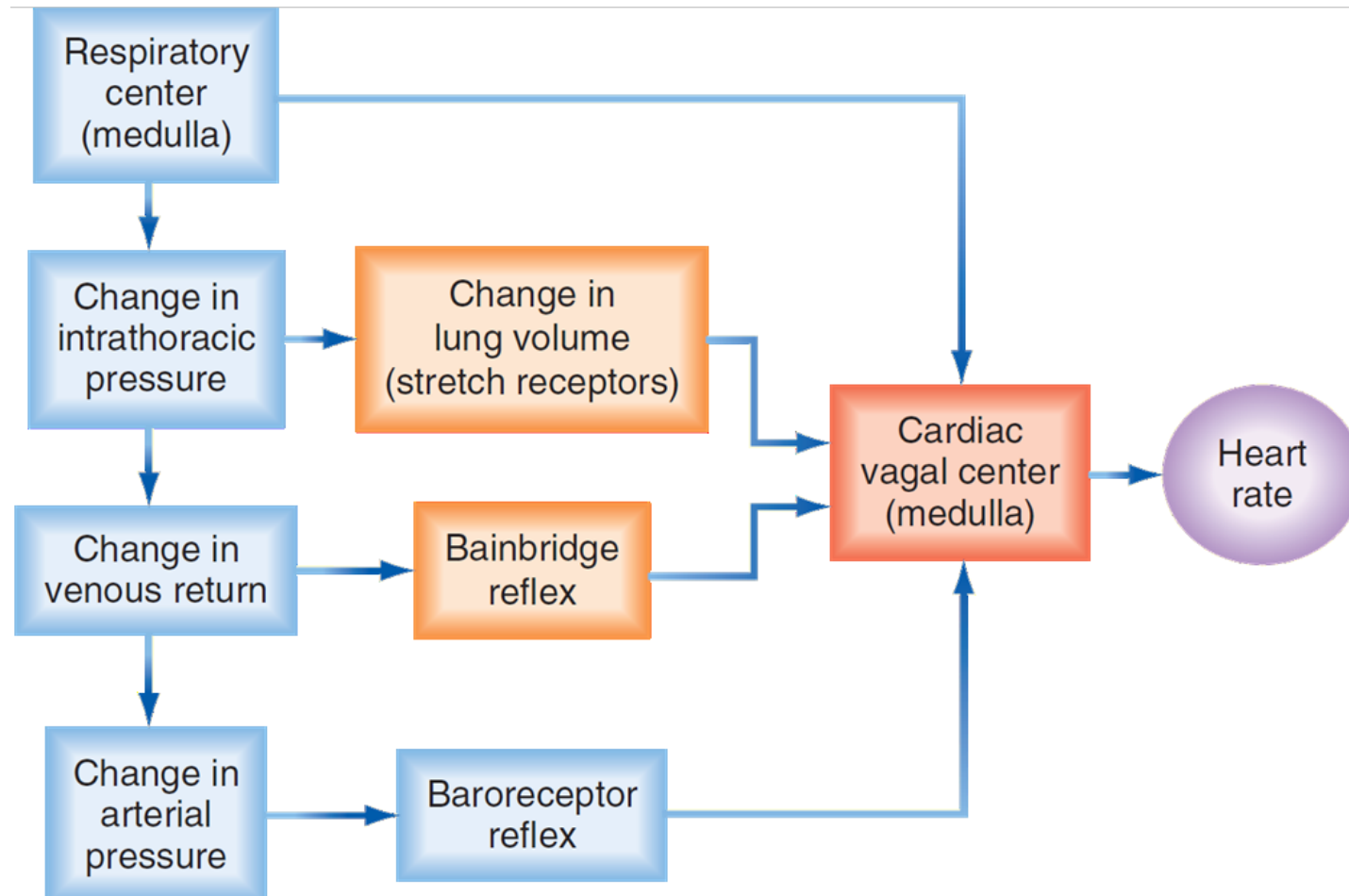
- Inotropní
 - Chronotropní
 - Dromotropní
 - Bathmotropní
- efekt



$$TK = TF \times SO \times PO$$

TF - tepová frekvence, SO - systolický objem, PO - periferní odpor

Respirační sinusová arytmie



Něco navíc....

Okulokardiální reflex

- Tlak na oční bulby snižuje tepovou frekvenci (aktivace n.vagus)
- Lze využít k potlačení či úplnému zastavení náhle vzniklé srdeční tachykardie

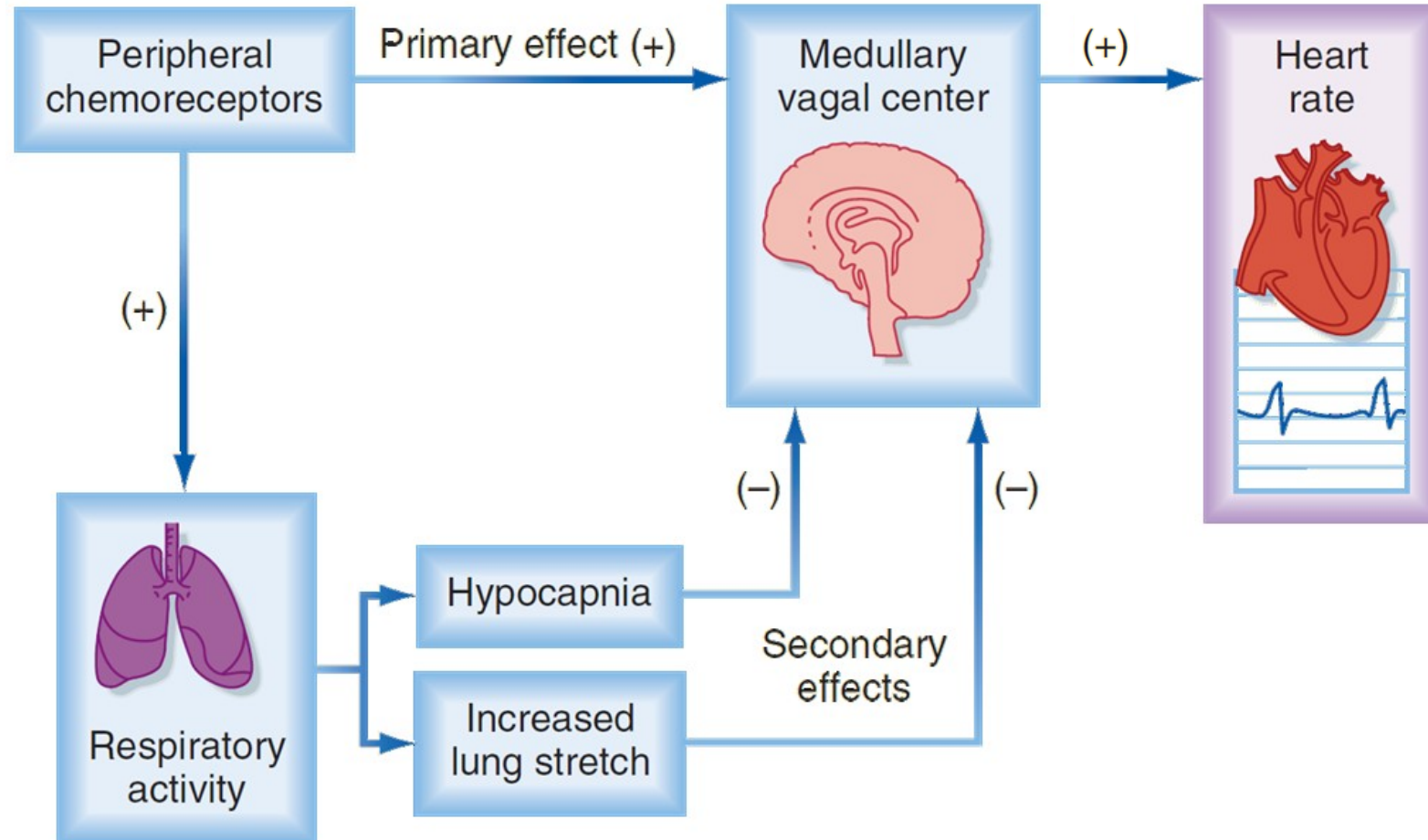
Potápěcí reflex

- Ponoření obličeje do studené vody je doprovázeno zástavou dýchání, periferní vazokonstrikcí, bradykardií (až srdeční zástavou).

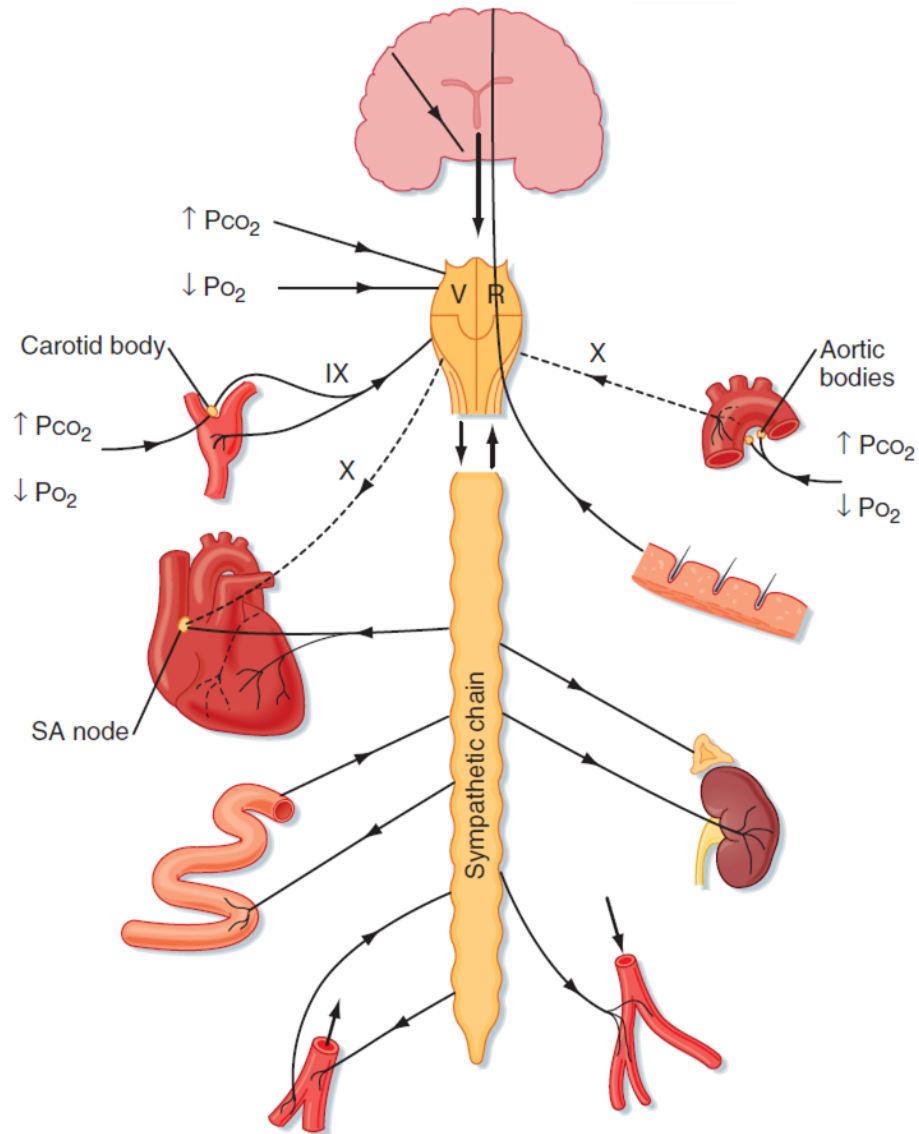
Koronární chemoreflex (Bezoldov-Hirtov-Jarischův reflex)

- Při aplikaci některých látek do levé koronární arterie (např. veratridine, kapsaicin, některé kontrastní látky, produkty ischemizující tkáň) vyvolají zástavu dechu (apnoe) a poté hyperpnoe, hypotenzi, bradykardii (aktivace n.vagus)

Chemoreflex

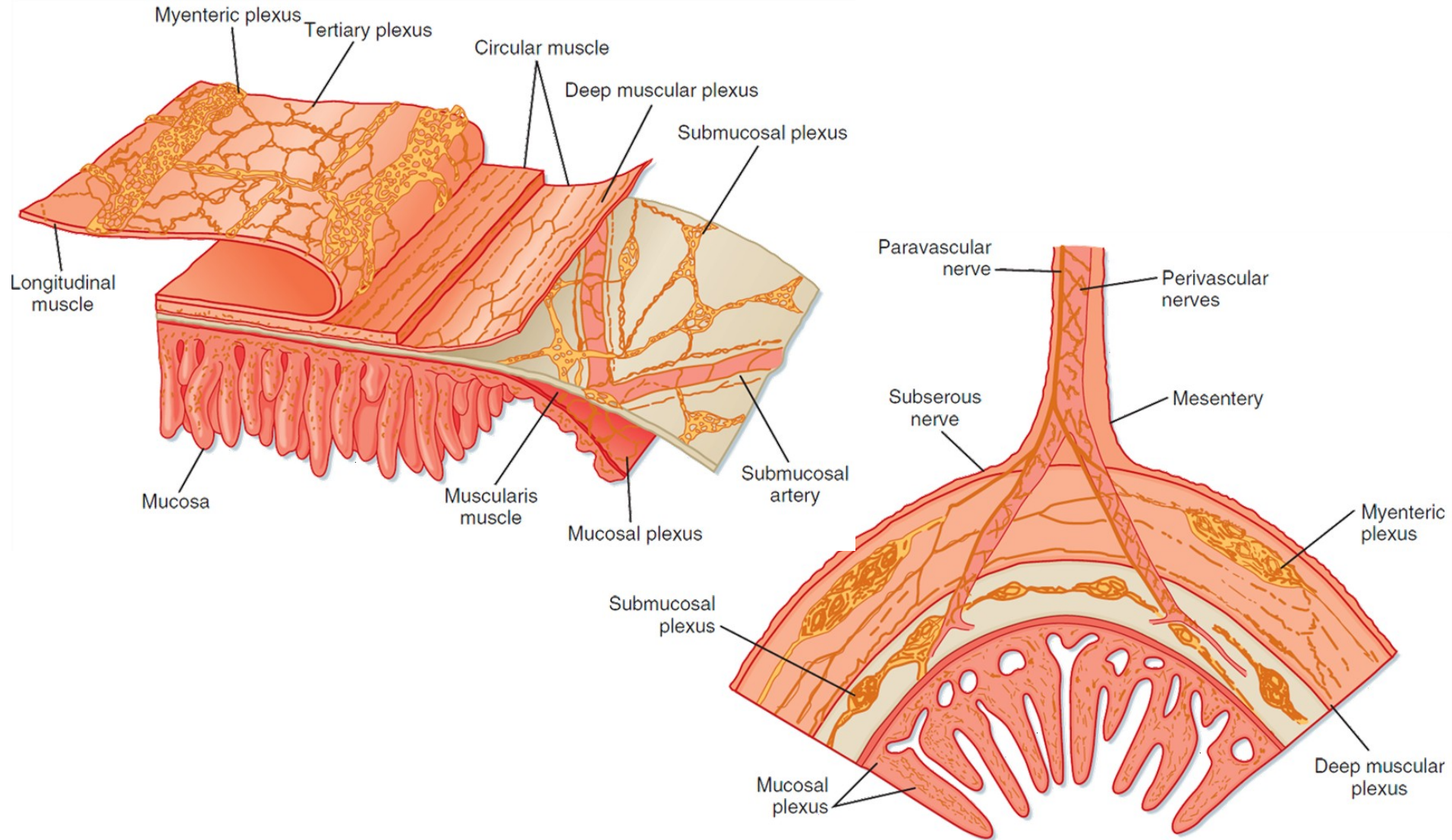


ANS and cévy



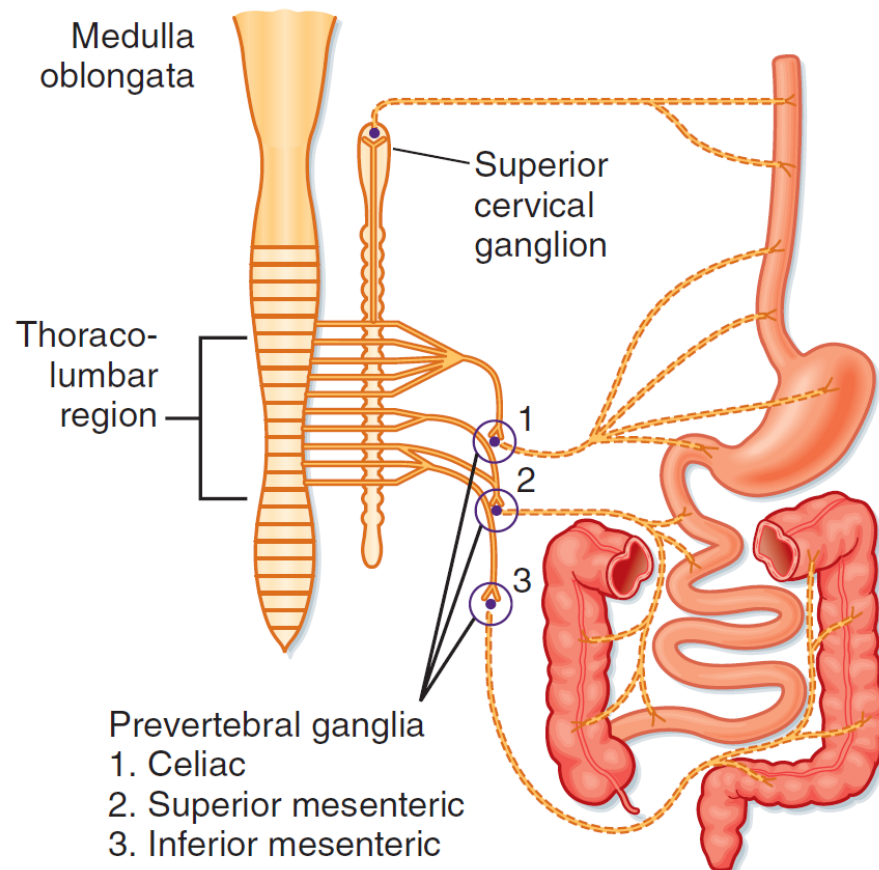
EFFECTORS	RECEPTORS	ADRENERGIC REACTION
CORONARY A.	α, β_2	C, D
SKIN A.	α	C
SKELETAL MUSCLE	α_1, β_2	C, D
BRAIN A.	α	C
LUNGS A.	α, β_2	C, D
ABDOMINAL A.	α, β_2	C, D
VEINS	α, β_2	C, D

GIT – Enterický nervový systém

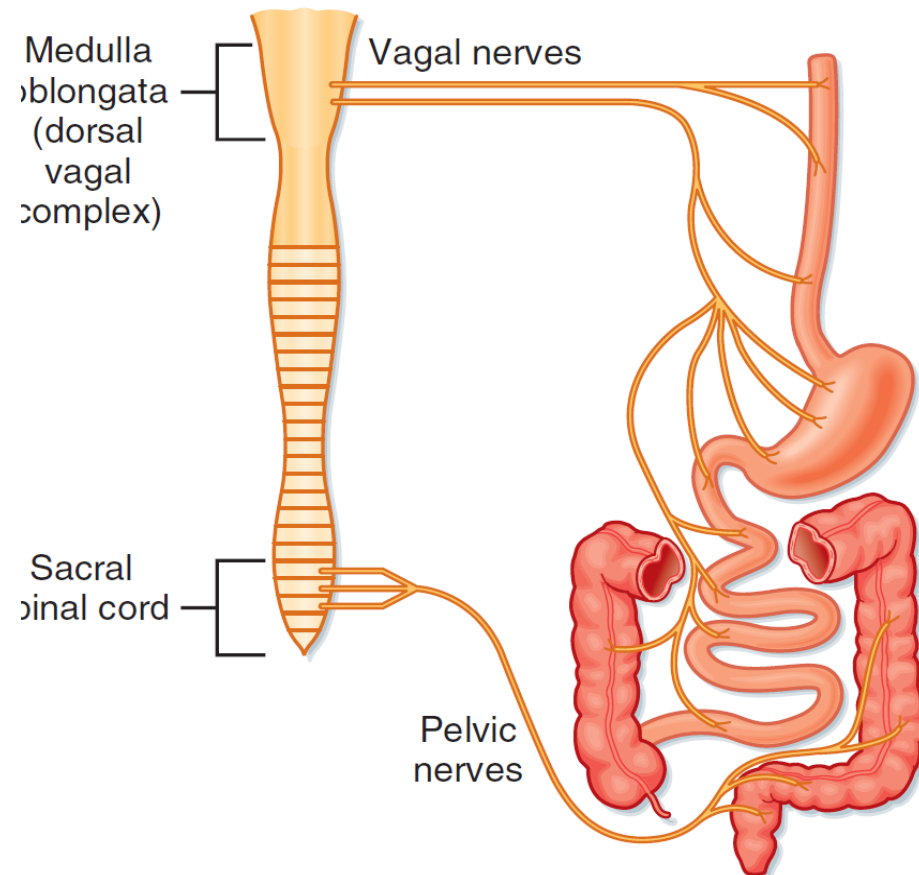


GIT a ANS

SNS



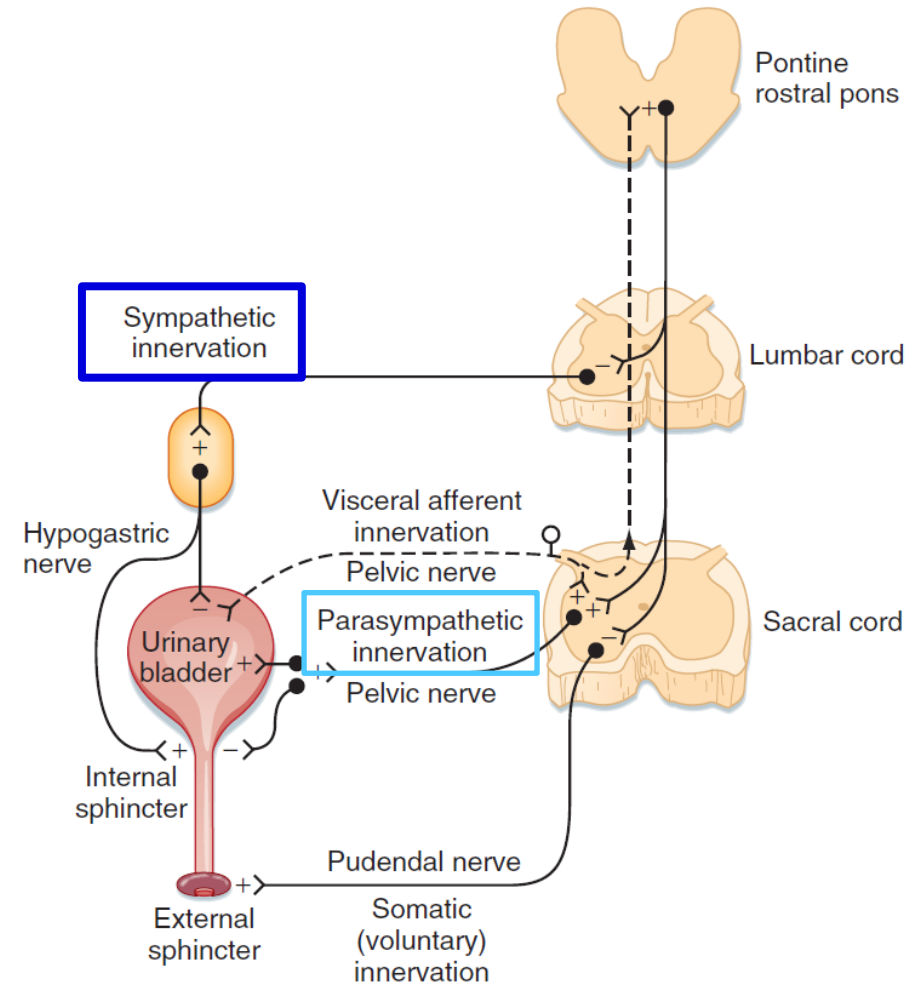
PNS



ANS a močový měchýř

SNS	
DETRUSOR	RELAXATION
SPHINCTER	CONTRACTION

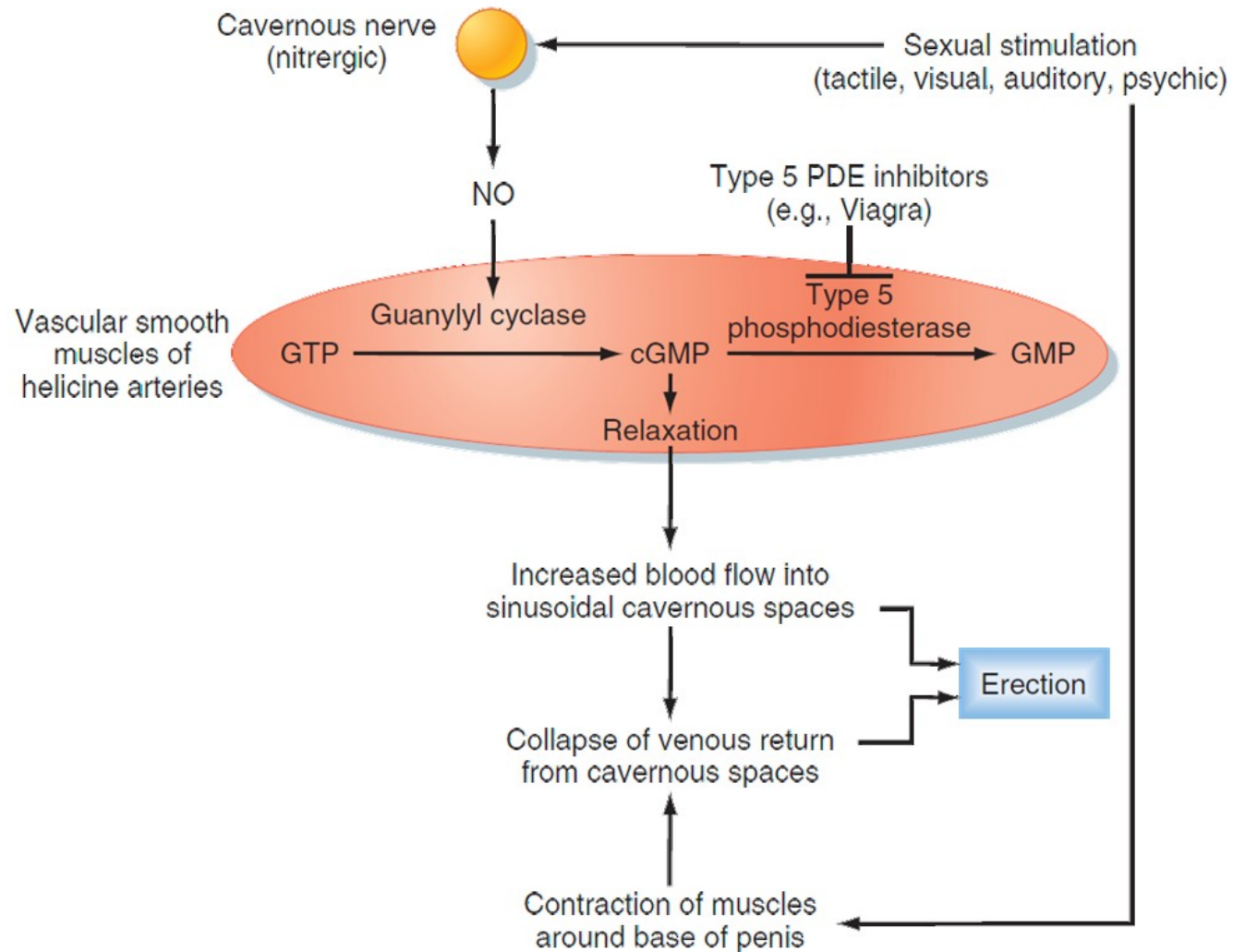
PSN	
DETRUSOR	CONTRACTION
SPHINCTER	RELAXATION



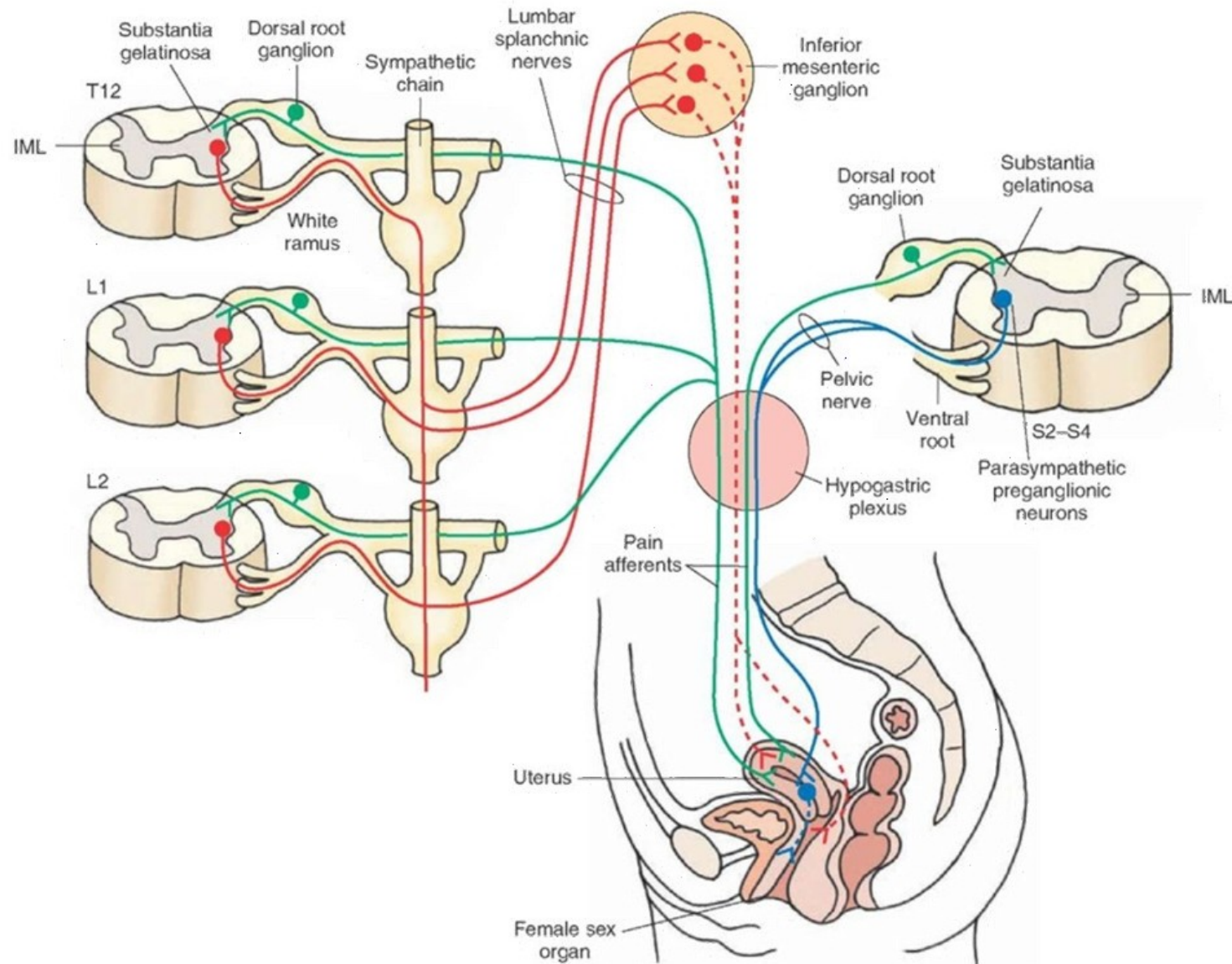
Neurogenní močový měchýř

NAME	COMMENTS
Uninhibited bladder	Lesion: above the pontine micturition center Signs: reduced awareness of bladder fullness, incontinence may occur
Upper motor neuron bladder (Detrusor-sphincter dyssynergia)	Lesion: between the pontine micturition center and sacral cord Signs: detrusor is usually spastic, simultaneous detrusor and urinary sphincter contractions increase pressures in the bladder, can lead to vesicoureteral reflux that and renal damage
Mixed type A bladder	Lesion: sacral cord lesion at the detrusor nucleus with sparing of the pudendal nucleus Signs: the detrusor muscle is flaccid, bladder is large, external urinary sphincter is spastic, incontinence uncommon
Mixed type B bladder	Lesion: sacral cord lesion at the pudendal nucleus with sparing of the detrusor nucleus Signs: the bladder is spastic and the external urinary sphincter is flaccid, incontinence is common
Lower motor neuron bladder	Lesion: sacral cord or sacral root while the thoracic sympathetic outflow to the lower urinary tract is preserved Signs: bladder is large and hypotonic, incontinence uncommon

ANS a sexuální funkce



ANS a sexuální funkce



Děkuji za pozornost