

PHARMACOLOGY OF PERIPHERAL NERVOUS SYSTEM

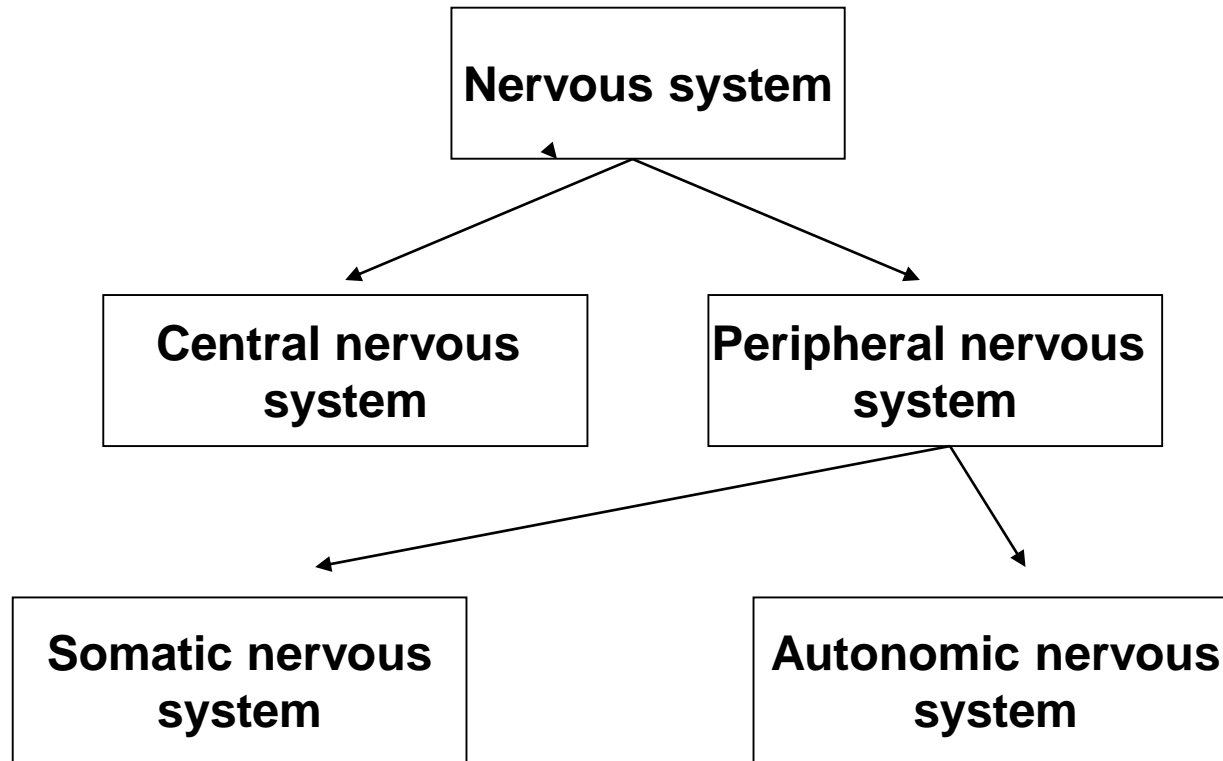
AUTONOMIC NERVOUS SYSTEM

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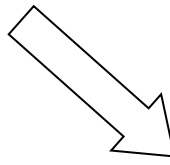
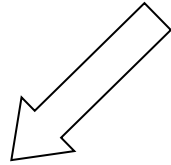
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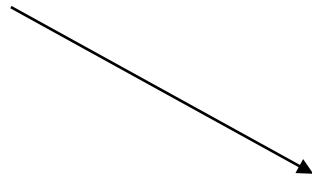
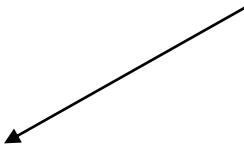


Autonomic nervous system



central part

peripheral part



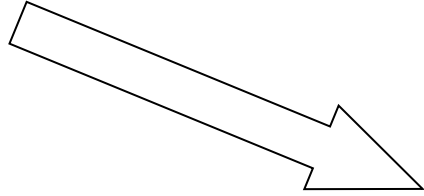
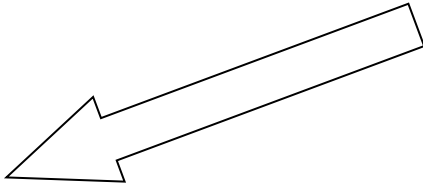
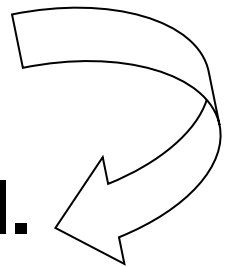
HYPOTHALAMUS
MEDULLA OBLONG.

-afferent system

efferent system

- non - myelinated fibers
- pain perception
- visceral perception

vegetative nerves + ggl.



SYMPATHETIC
NERVOUS SYSTEM

PARASYMPATHETIC
NERVOUS SYSTEM

Main functions of ANS

- contractions and relaxations of smooth muscles
- function of all exocrine and some of endocrine glands
- heart functions
- metabolic functions

ANS

Sympathetic

= adrenergic system

- thoracolumbal s.
- fight or flight
- noradrenaline(NA)
- α a β receptors

Parasympathetic

= cholinergic system

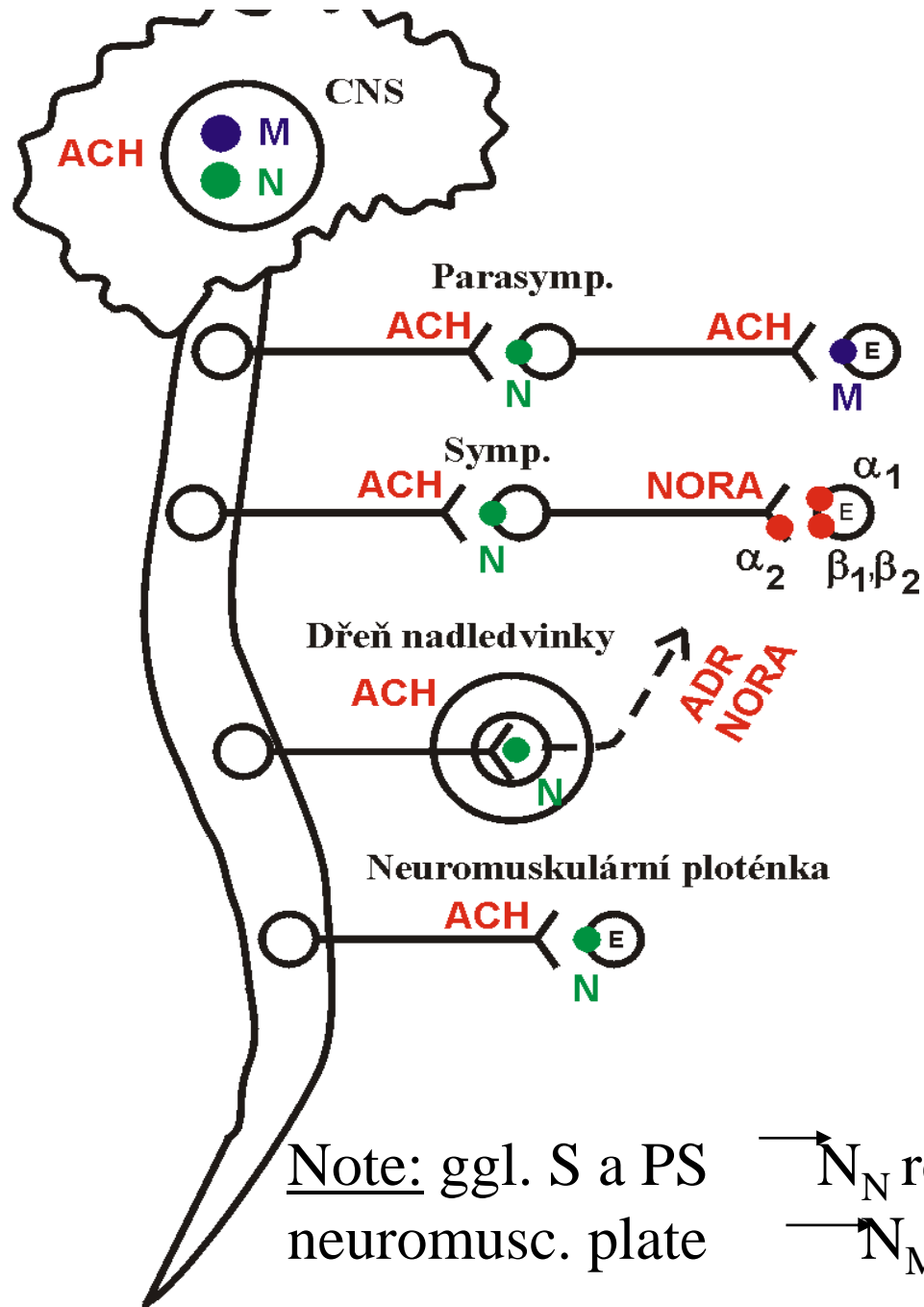
- craniosacral s.
- rest and digest
- acetylcholine
- N a M receptors

Autonomic nervous system

The activity is mutually regulated

- heterotropic interactions
- homotropic interactions
- most of visceral organs is innervated by both S and PS
- opposite activity - bronchi, heart, bladder,,...
- similar action – salivary glands
- only S – blood vessels

Obr. 1. Autonomic nervous system



Note: ggl. S a PS
neuromusc. plate

→ N_N receptors
→ N_M receptors

Autonomic acting pharmaceuticals

On the basis of mechanism of action - drugs:

1. **binding to the receptors** for Ach or NA:

a) starting reaction = **agonist - DIRECT MIMETICS**

b) receptor blockade = **antagonist – DIRECT LYTICS**

.....

2. **changing the synaptic concentration of NT –**

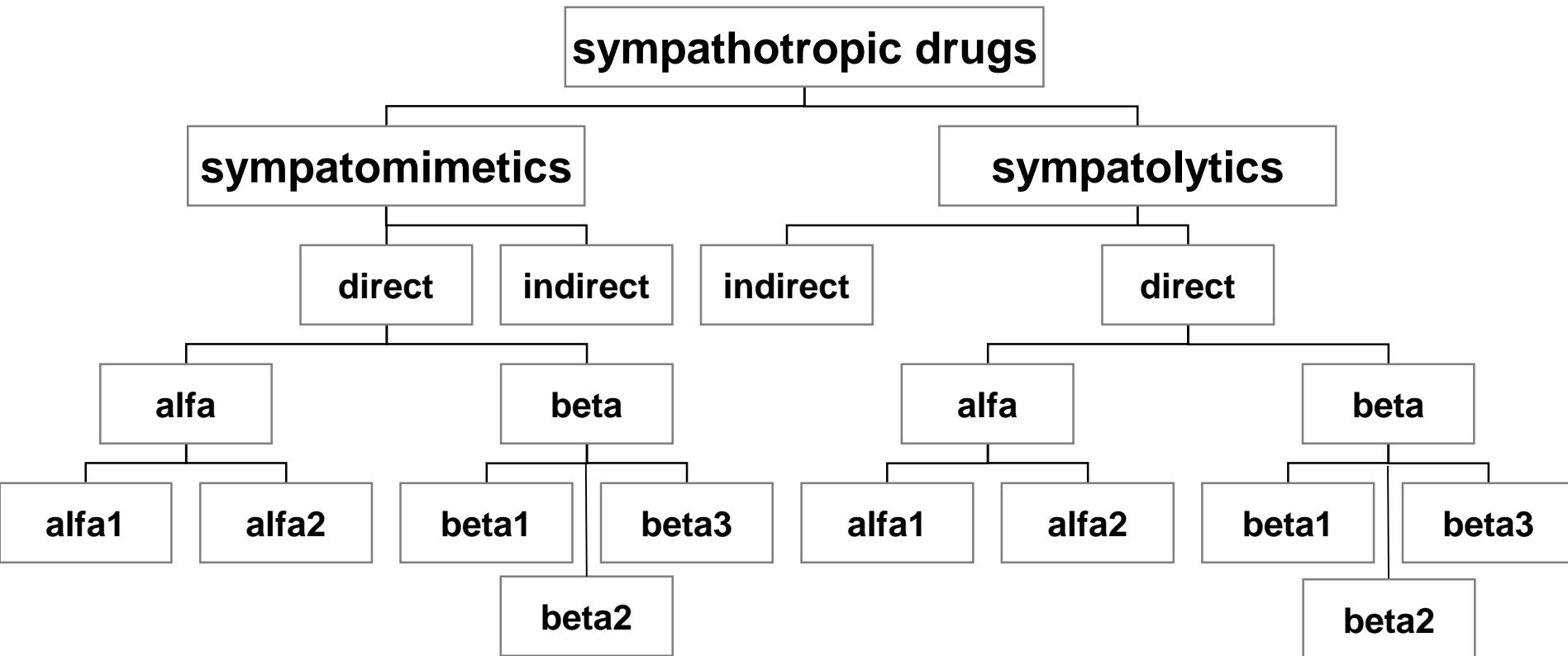
intervene in the fate of the Ach or NA (affect the synthesis, storage, release from nerve endings, inactivation); do not bind directly to receptors on the effector organs

a) increase of NT effect = **INDIRECT MIMETICS**

b) decrease of NT effect = **INDIRECT LYTICS**

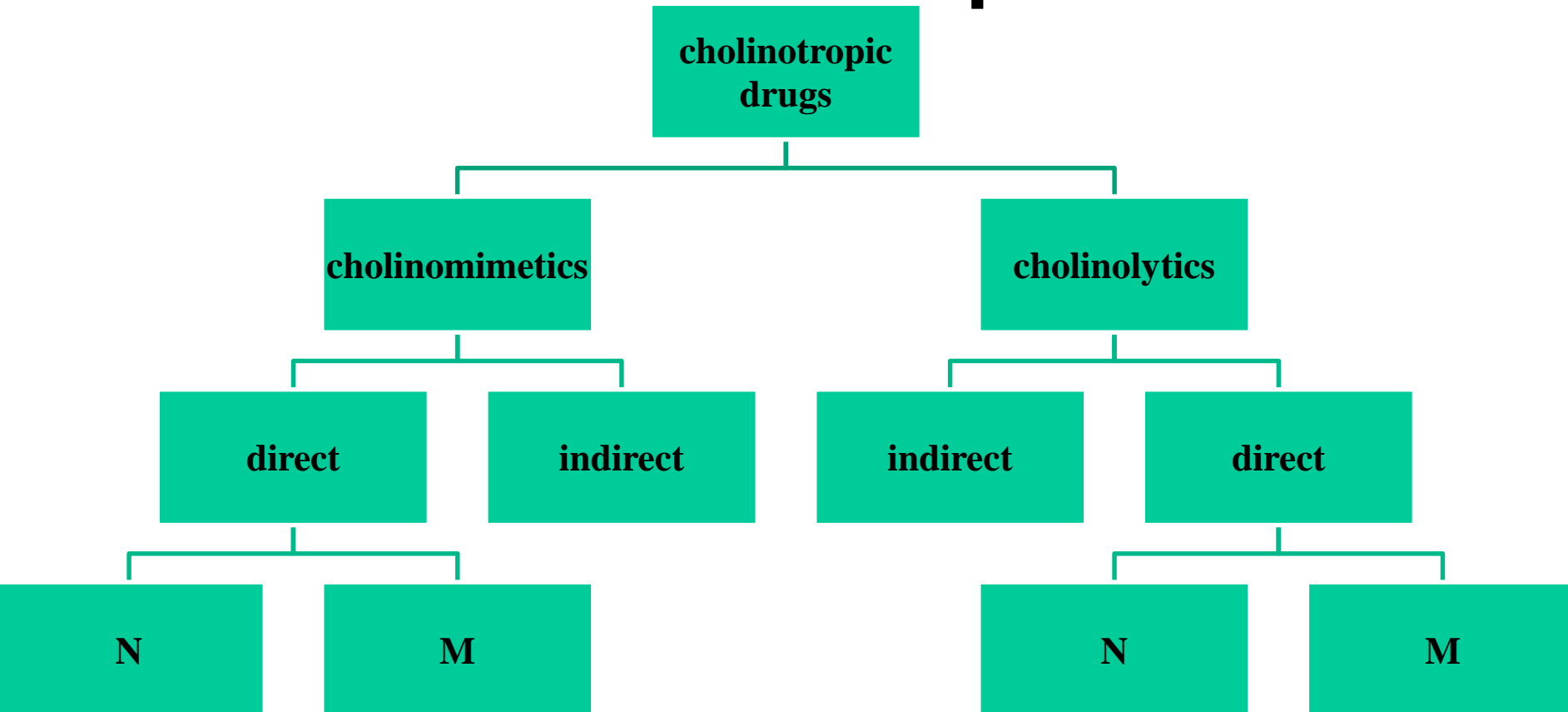
Vegetative acting drugs

2. sympatotropic



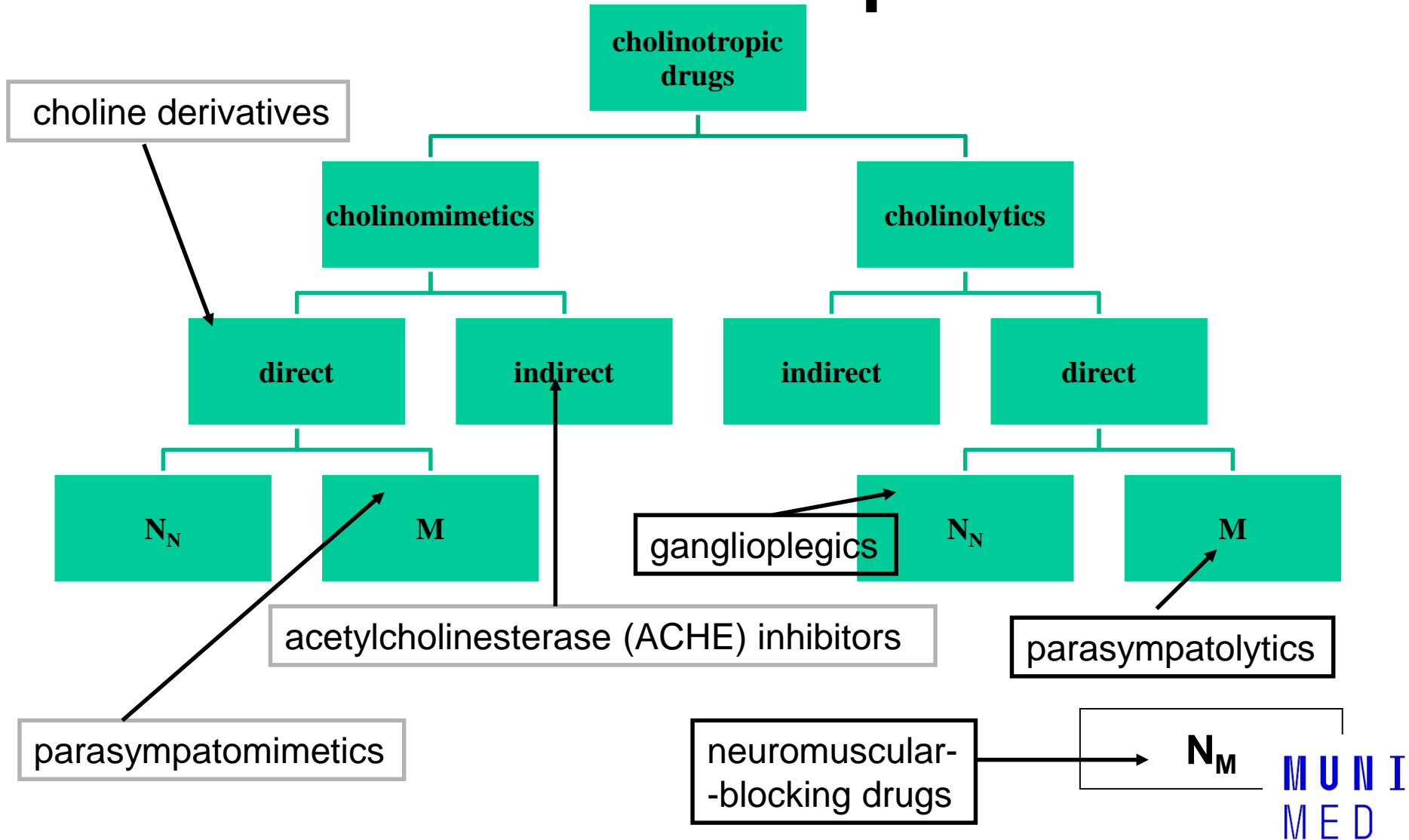
Vegetative acting drugs

2. cholinotropic



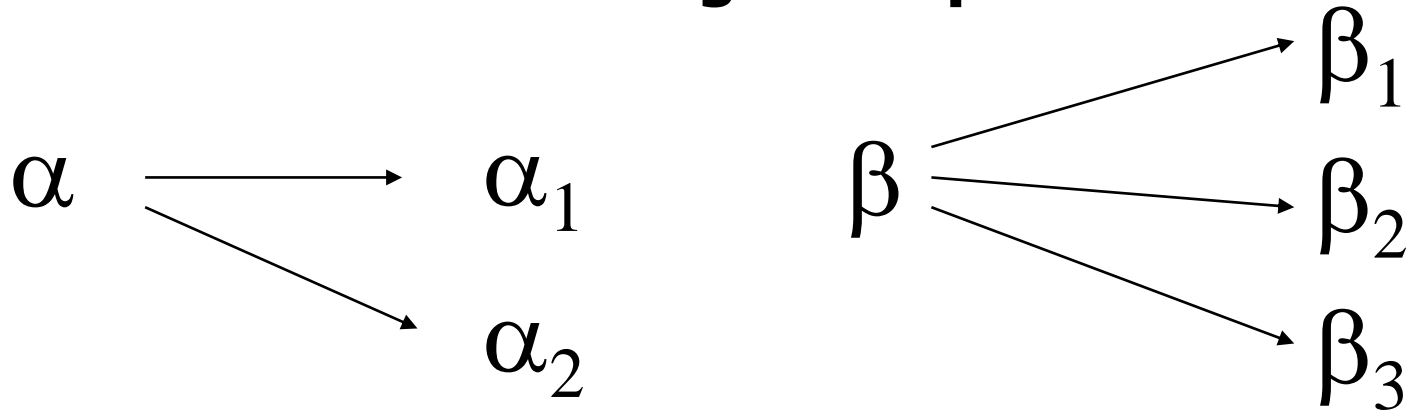
Vegetative acting drugs

2. cholinotropic



ANS RECEPTORS

adrenergic receptors



cholinergic receptors

NICOTINE: N

- skeletal muscle N_M
- vegetative ganglia N_N
- (CNS)

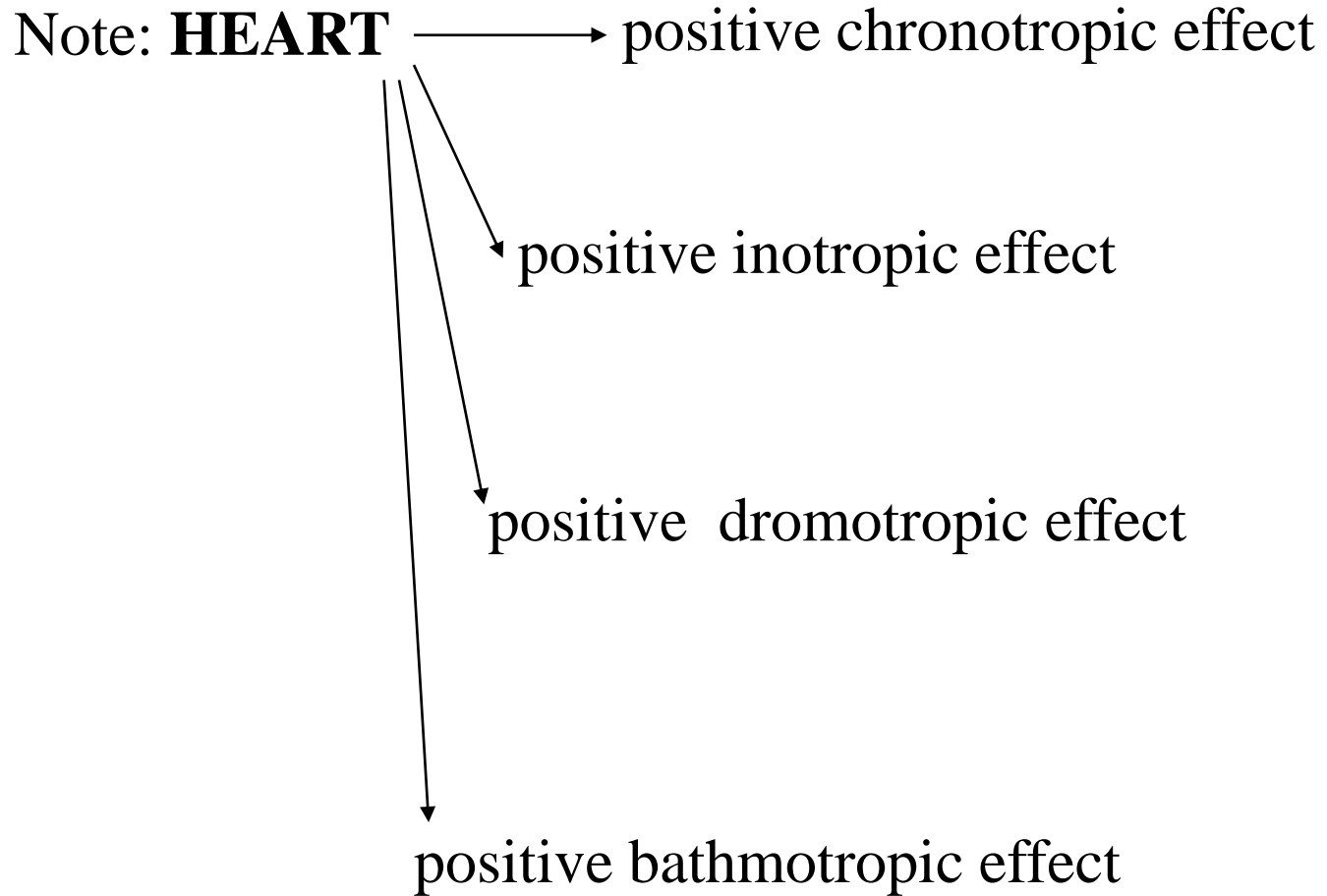
MUSCARINIC:

M_1, M_2, M_3, M_4, M_5

organ	receptor		sympathetic system	parasympathetic system
heart	β_1	M	+ chrono, dromo, bathmo, inotropic	- chrono, dromo bathmo, inotrop.
eye	α_1 β_2	M	mydriasis acomodation into the distance	miosis acom.to close
respiratory tract	(α_1) β_2	M	bronchoconstriction <u>bronchodilatation</u>	<u>bronchoconstriction</u> \uparrow secretion
blood vessels	α_1 (α_2) β_2	M	<u>vasoconstriction</u> vasoconstr. dilatation (coronary, blood vessels in skeletal muscles)	dilatation

organ	receptor		sympathetic system	parasympathetic system
GIT	$\underline{\alpha}_1$	M	↓ motility and tone sphincter contraction secretion inhibition	↑ motility sphincter relaxation secretion stimulation ↑ gastr. secretion
	α_2 $\underline{\beta}_2 > \beta_1$	M		
urinary bladder	α_1 β_2, β_3	M_3	sphinct. contraction relax. of the bladder wall	sphinct. relaxation contract. of the bladder wall
kidney	$\underline{\beta}_1 > \beta_2$		↑ renin secretion	
uterus	α_1 β_2		contraction relaxation-tocolysis	

organ	receptor	sympathetic system	parasympathetic system
liver	α_1, β_2	glycogenolysis gluconeogenesis	
pancreas	α_2 β_2	↓insulin secretion ↑insulin secretion	
sexual organs	α_1 M	ejaculation	erection
glands	α_1 M β_2	sparse secretion viscous secretion	sparse significantly increased secretion



Adrenergic receptors

- metabotropic
- α_1 , α_2 a β_1 , β_2 a β_3
- stimulated by noradrenaline (norepinephrine)

Receptor α_1 stimulation:

- vasoconstriction (skin, mucous membranes, splanchnic area,..)
- mydriasis
(+ \downarrow intraocular pressure)
- contraction of pregnant uterus
- ejaculation
- urinary bladder sphincter contraction, GIT sphincter contraction
- glycogenolysis and gluconeogenesis stimulation
- (reduce secretion of bronchial glands)

Receptor α_2 stimulation:

- (presynaptic) increased NA release (espec. in CNS)
- stimulation of platelet aggregation
- vasoconstriction in local application, otherwise the influence of stimulation of central receptors to reduce sympathetic tone and BP
- hypotensive effect of central mechanism
- inhibition GIT secretion
- inhibition of lipolysis, increased fat storage

Receptor β_1 stimulation :

heart:

- \uparrow HR (+ **chronotropic** effect) SA node
- \uparrow automaticity (+ **bathmotropic**) AV node, ventricles
- \uparrow force of heart contraction (**inotropic effect**)
- \uparrow conduction (**dromotropic effect**)
- \uparrow oxygen consumption

kidney:

- \uparrow renin secretion

Receptor β_2 stimulation:

- vasodilatation, espec. in skeletal muscles ("preparation for fight or flight"), \downarrow diastol. BP, vasodilatation in coronar blood vessels
- bronchodilatation
- relaxation of uterus (indic. in impending preterm birth)
- intestine wall relaxation
- intestinal passage decrease
- urinary bladder wall relaxation
- glycogenolysis - \uparrow glycemia, increased insulin secretion
- blockade of mast cells degranulation

Receptor β_3 stimulation:

- *lipolysis*
- *urinary bladder wall relaxation (m. detrusor)*

Cholinergic receptors

MUSCARINIC:

M₁ („neural“) – CNS, peripheral neurons, parietal cells of stomach, (glands with external secretion)

M₂ („heart“) - heart (SA, atria, AV, ventricles), (smooth muscle (GIT), neuronal tissue), presynapt. neur. endings

M₃ – glands, blood vessels (smooth muscle, hl. sval, endothelium), smooth muscles: bronchial muscles, GIT, urinary bladder, eye

M₄ – salivary glands, GIT (muscles), eye, CNS

M₅ – lungs, CNS

Cholinergic receptors

- M – metabotropic
- stimulated by acetylcholine
- N – coupled with ion channels
- stimulated by nicotine