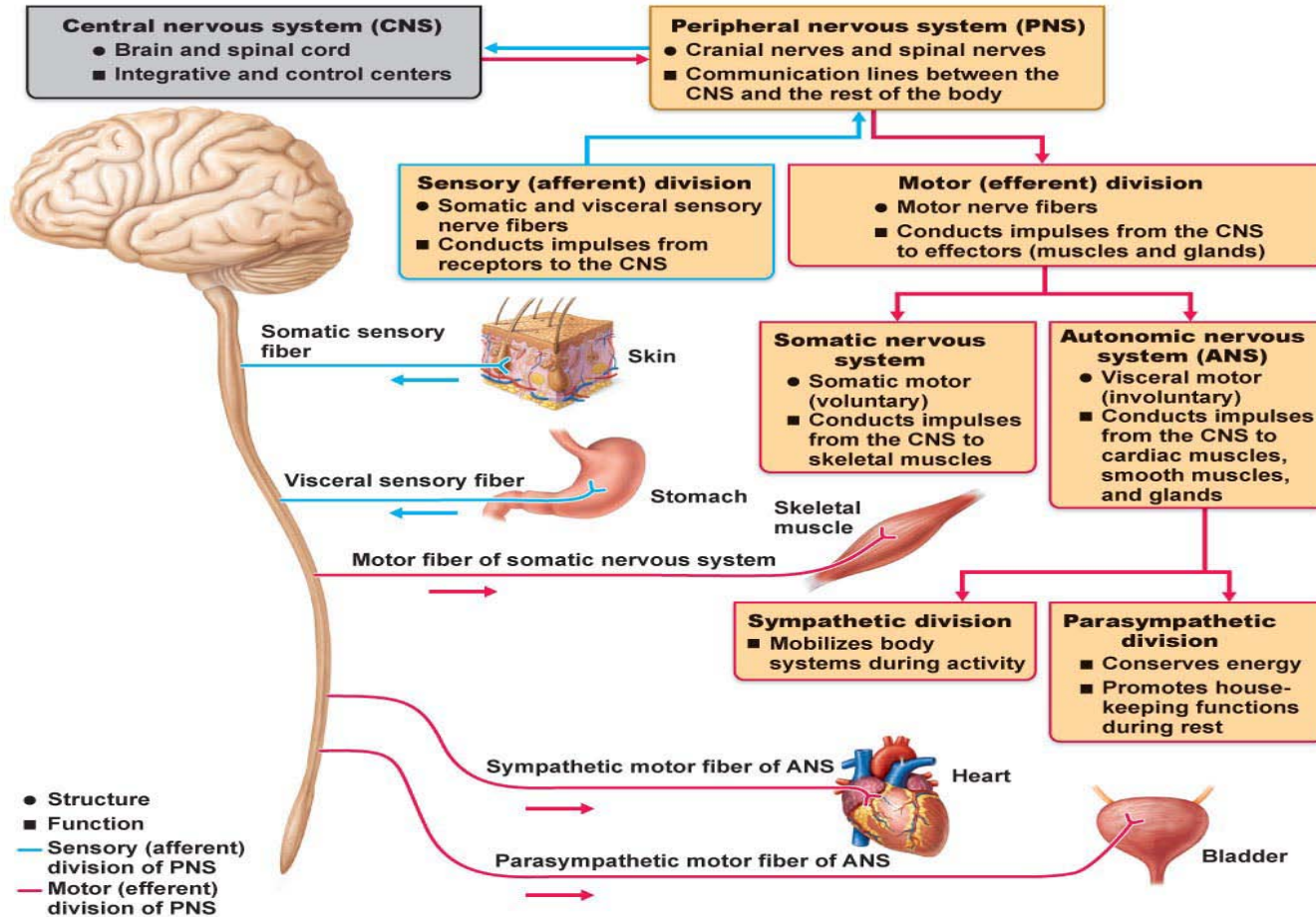
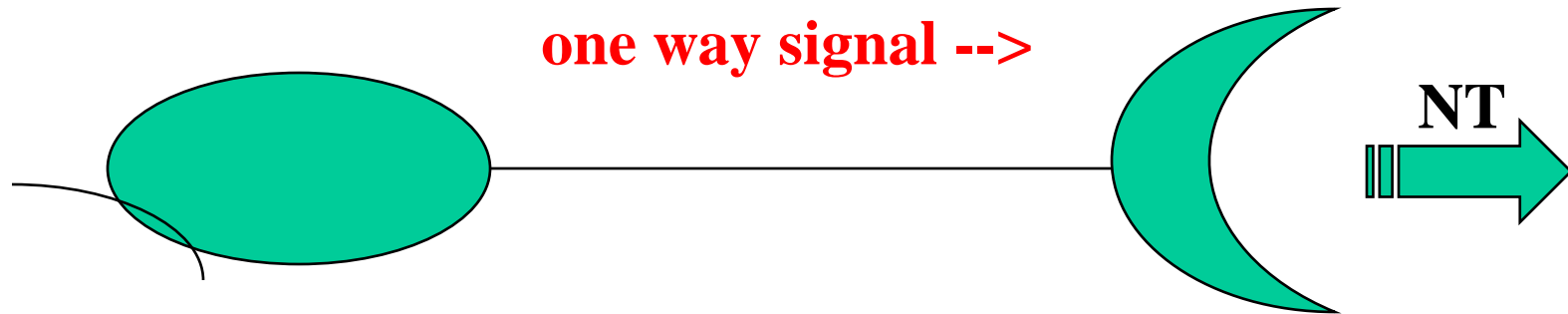


Nervous Sys. Org. (1)



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Neuron Diagram



cell:

dendrite

soma

axon

axon term.

syn. cleft

signal:

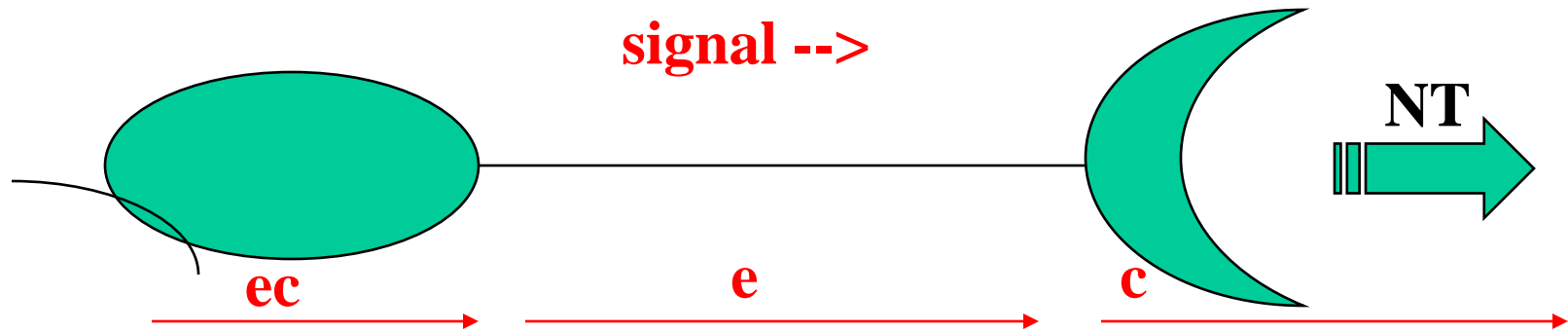
receive

receive/integ.

transmit

relay to next cell(s)

Neuron - Signal Review



signal transmission:

ec
- electro-chem
- EPSP, IPSP

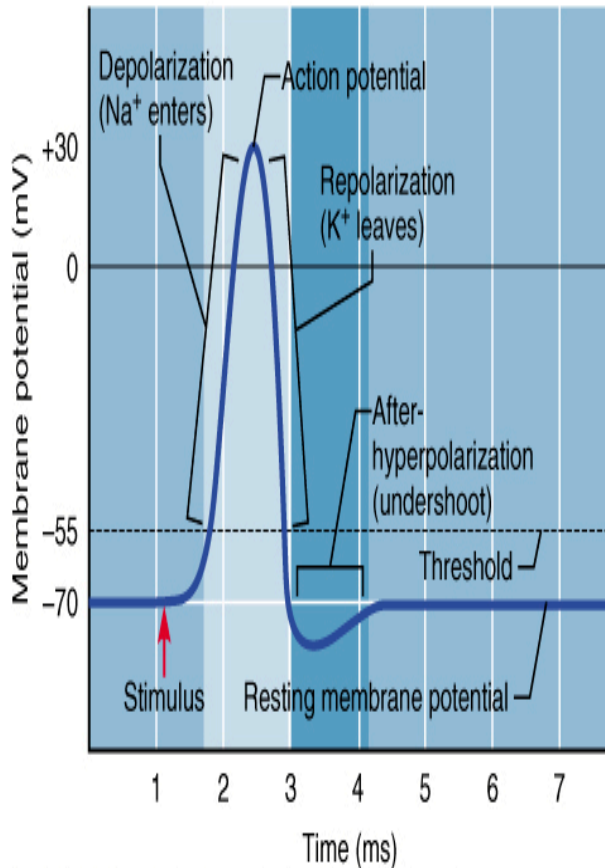
e
electrical
- AP

c
chemical
- NT

Sample Elec. Recordings

neuro-gram (AP)

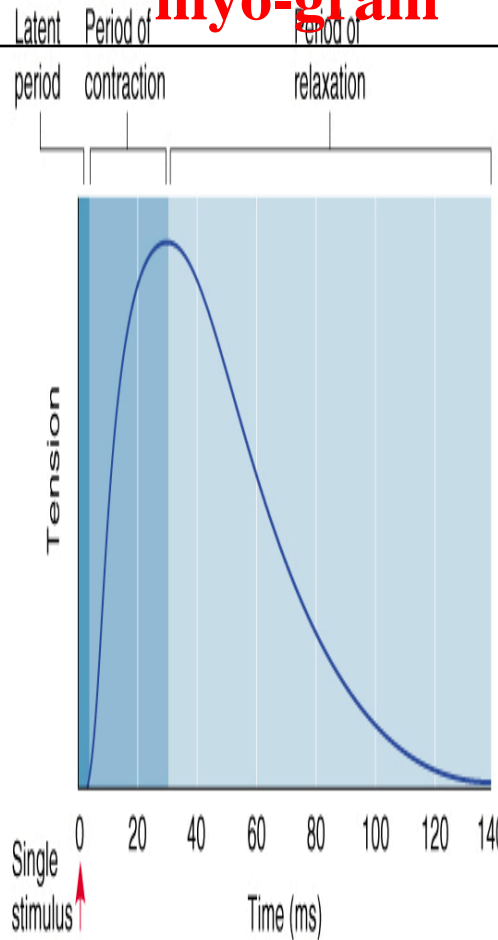
Absolute refractory period Relative refractory period



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7/19/2011

myo-gram

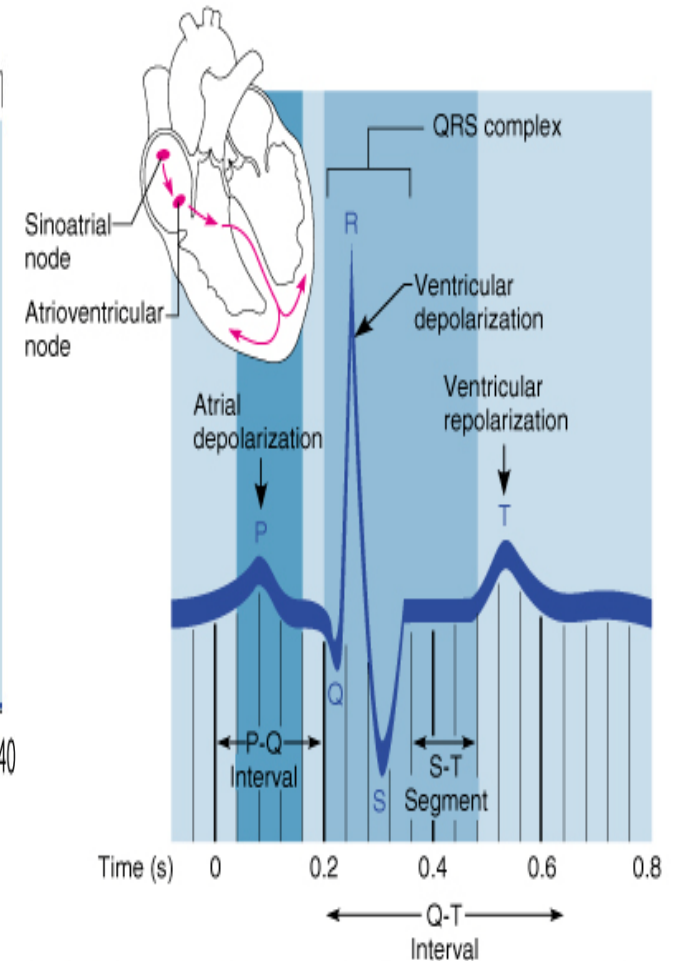


(a)

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Neurophysiology - Sandra Hsu

cardio-gram (EKG)



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4

4 Phases

- 1) **RMP (resting membrane potential)**
= rest state
- active transport: **Na⁺ out, K⁺ in**

- 2) **DEP (depolarize)**
= change polarity
- diffusion: **Na⁺ in**

- 3) **REP (repolarize)**
= return to original polarity
- diffusion: **K⁺ out**

- 4) **HYP (hyperpolarize)**
= excess return to original polarity
- diffusion: **K⁺ out**

Ion Flow Review

	RMP	DEP	REP	HYP
1) forces	act. tran.	diff.	diff.	diff.
2) flow	Na out, K in	Na in	K out	K out
3) gates	Na closed K closed	Na open K closed	Na closed K open	Na closed K closed
4) resist.	none	absolute	absolute	relative
5) polarity	out: + in: -	out: - in: +	out: + in: -	out: + in: -

AP - Resistance

refractory period

= when 2nd stimulus cannot be accepted

a) absolute refractory period

- no response to 2nd stim.**
- 1st msec**
- initial RMP, DEP, initial REP**

b) relative refractory period

- limited response to 2nd stim.**
- 2nd to 4th ms***
- late REP, HYP, late RMP**

***older text: AP = 3 ms; new text: AP = 4 ms**

Propagation Regions

3 regions along length of axon:

a) Na closing region (REP/HYP)

= **refractory region**

- Na gates closing

- K gates open \rightarrow \uparrow K exflux (diffusion)

b) Na opening region (DEP)

= **depolarizing region**

- Na gate open \rightarrow \uparrow Na influx (diffusion)

- K gates closed

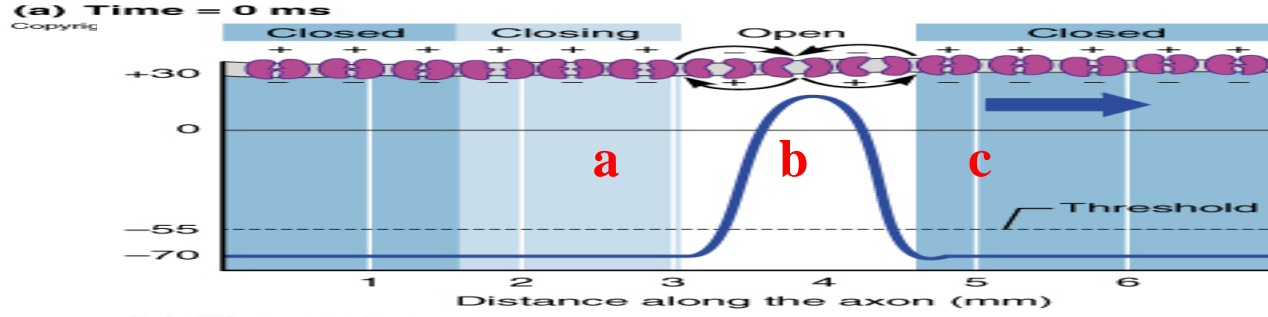
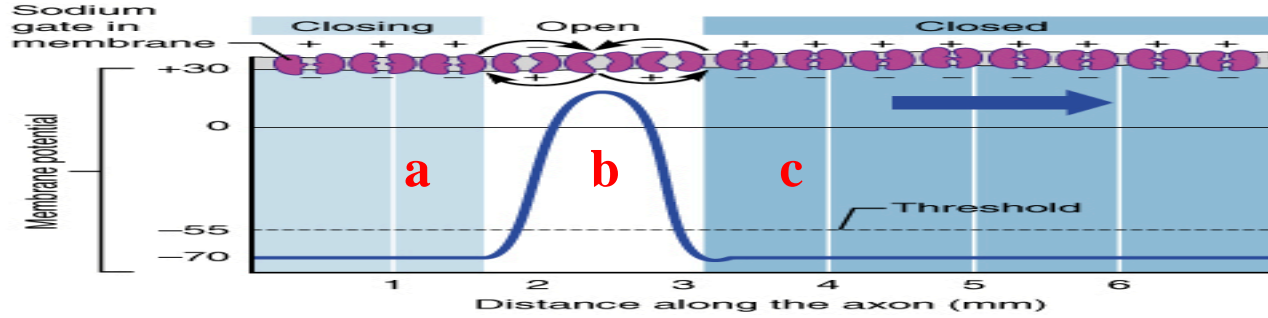
c) Na closed region (RMP)

= **next stimulating region**

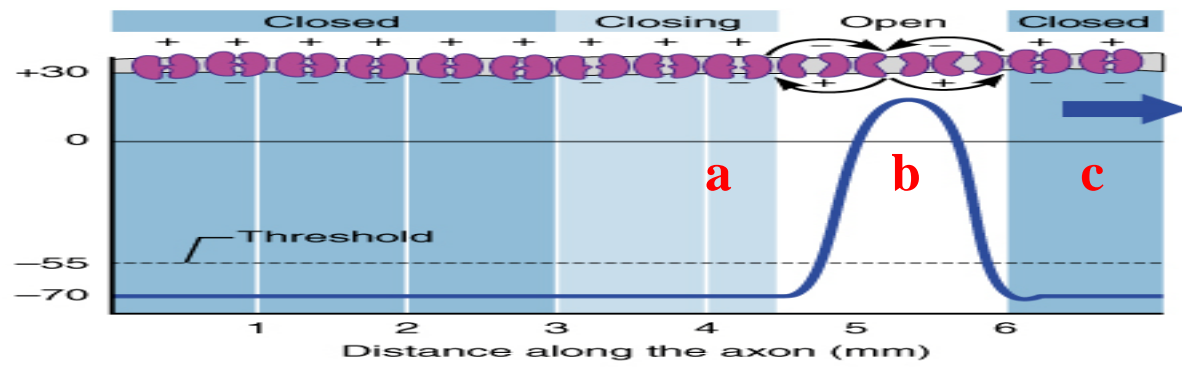
- Na & K gates closed

- Na-K pump active: Na out; K in

Unmyelin. Propagation (2)



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Fiber Types

feature	A	B	C
1) diameter	thick	intermed.	thin
2) myelin	thick	thin	none
3) location	SNS sensory	sensory	ANS sensory
4) cond. speed	fast 150 m/s 300 mph	intermed. 15 m/s 40 mph	slow 1 m/s 2 mph
5) cond. type	saltatory	both	continuous

AP & PSP Comparison

	AP	EPSP	IPSP
1) function	long dist. signal	short dist. signal	short dist. signal
2) amplitude	same	graded	graded
3) gate	volt.-reg	chem-reg	chem-reg
4) stimulus	@-55 mV	excit. NT	inhib. NT
5) ion flow	4 phases:	sim. dif. net: Na⁺ in	sim. dif. net: K⁺ out
6) cell effect	axon depol.	soma depol.	soma hyperpol.

ACh - drugs, diseases

3) drugs:

cholinergic drugs

- a) ↓ postsynaptic AP → weak muscles, paralysis
 - 1) botulinus toxin (bacteria) - inhibit ACh release
 - 2) curare (tree resin) - competes for ACh receptors
 - 3) saxitoxin (red tide bacteria) - blocks NA gates
- b) ↑ postsynaptic AP → overactive muscles, spasms
 - 1) nerve gas (synthetic) - inhibits AChE release

4) diseases:

- a) myasthenia gravis - ↓ chol. muscle receptors → ↓ AP
→ muscle atrophy (deteriorate)
- b) Alzheimer - ↓ chol. CNS neurons → ↓ AP
→ mental deterioration

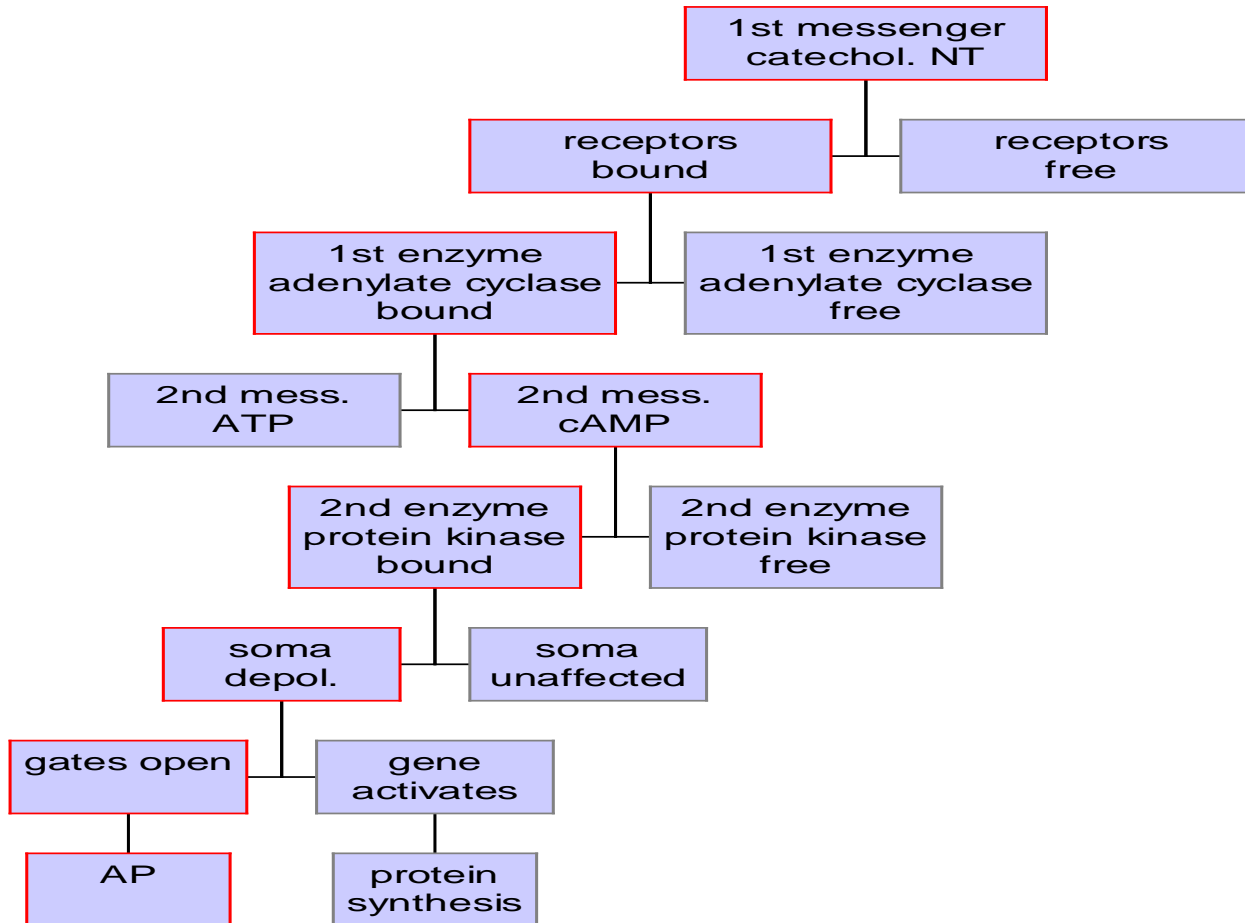
Biogenic Amines - feature

1) features

- **excitatory & inhibitory NT**
- **removal methods:**
 - a) **presynaptic cell reuptake**
 - b) **presynaptic cell deactivation (MAO)**
 - c) **postsynaptic cell deactivation (COMT)**
- **2 types:**
 - a) **catecholamines (dopamine, epi/nor-epi)**
 - b) **indolamines (serotonin, histamine)**
- **mechanism:**
 - **2nd messenger/enzyme activ. sequence**

Enzyme Activation Sequence

Catecholamine Effect



Catecholamines - site

dopamine epineph./nor-epi. .

a) excite/inhibit	both	both
b) presyn. storage	axon term.	axon term. & adrenals
c) postsyn. target	CNS	CNS, PNS (symp)
d) drugs	ampheta.	cocaine
e) drug effect	“feel good”	“feel good”

Catechol. - drugs, diseases

3) drugs:

- cocaine, amphetamines (uppers)
- block catechol. reuptake → cont. postsynaptic AP → cont. stim. → → → crash (all systems fall apart)

4) diseases:

a) Parkinsons:

- dopamine neuron degen. → speech, movement prob.
- treatment: L-dopa to stim. dopamine prod.

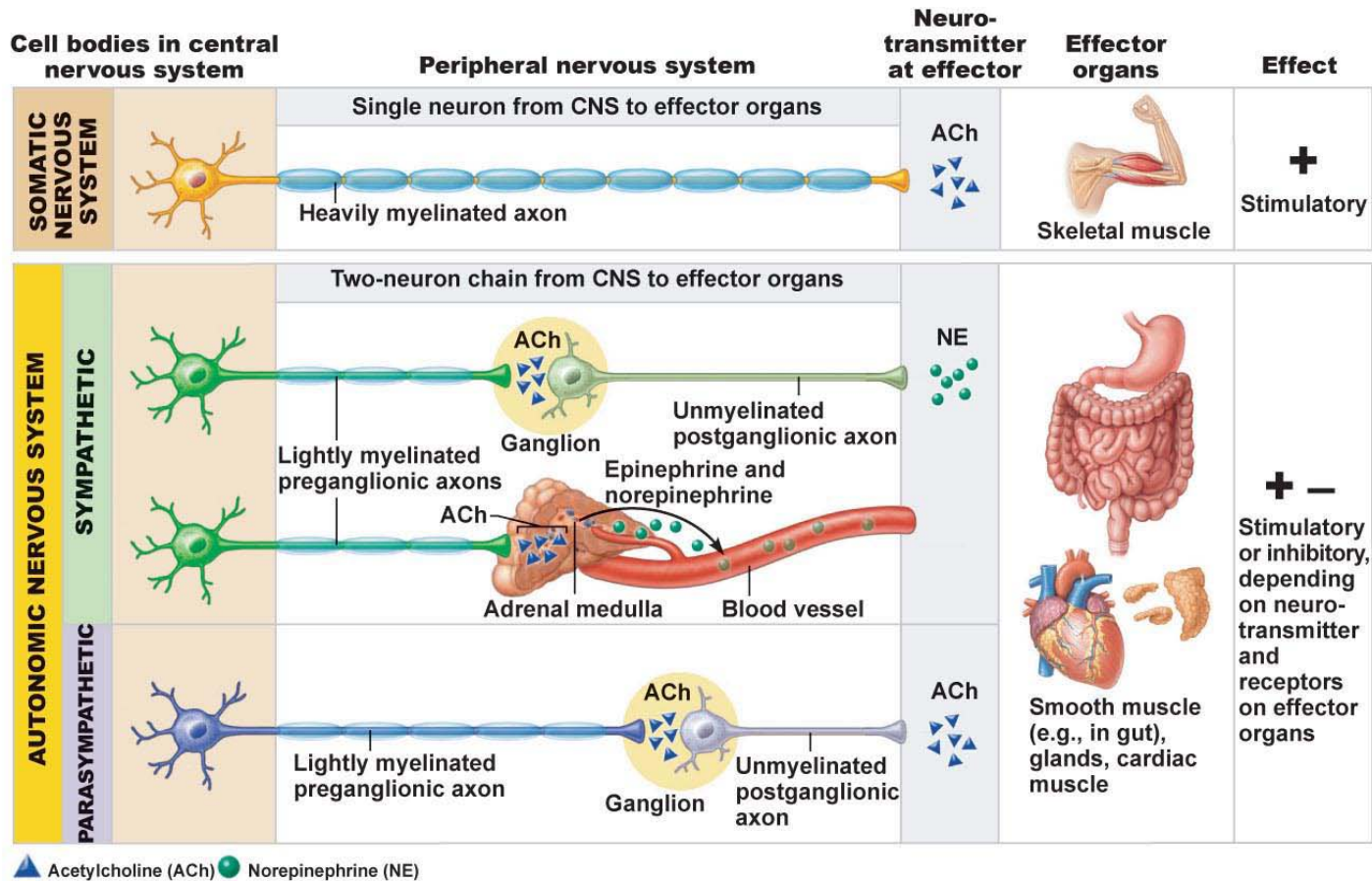
Q: dosage - too much → schizophrenia

b) schizophrenia:

- poss. overstim. of dopamine neurons

ANS - NT

ACh & Nor-epinephrine: decrease or increase HR



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Amino Acids - drugs, diseases

3) drugs

a) benzodiazepine (valium)

- $\uparrow \rightarrow \downarrow$

- \uparrow GABA effect \rightarrow \downarrow spasms (epilepsy, drug OD, poisons)
 \rightarrow tranquilizing effect (anxiety,

“nerves”)

b) strychnine

- block glycine receptors \rightarrow cannot relax antag. breathing muscles \rightarrow asphyxiation (unrelaxed diaphragm)

4) disease

a) Huntington's Chorea:

\downarrow GABA neurons \rightarrow uncontrolled movements