

FISIOLOGI SINAPS



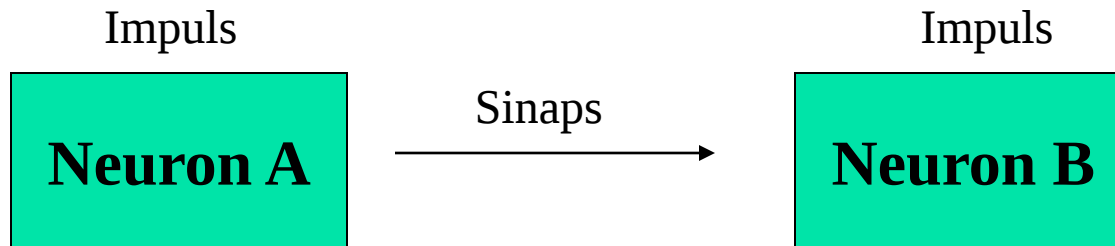
Point of view

- Mempelajari mekanisme transmisi impuls dari neuron ke neuron/sel lain
- Mempelajari faktor-faktor yang mempengaruhi mekanisme transmisi impuls pada point 1



Definisi & Pengertian

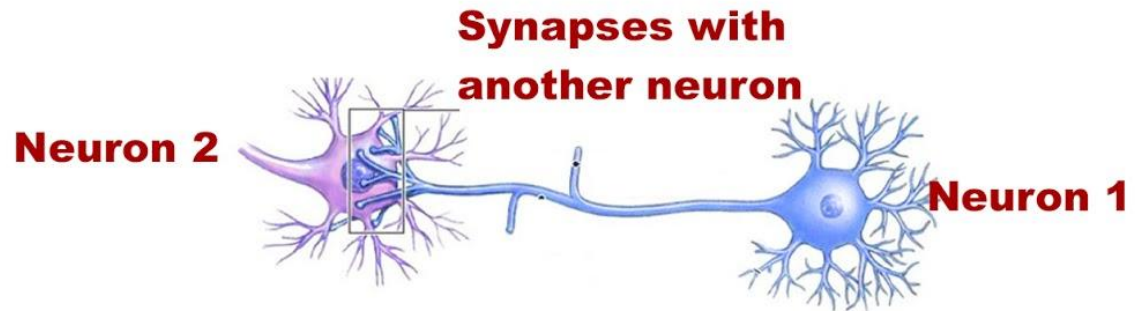
- Sinaps adalah hubungan antara 2 sel saraf.
- Fungsi : menghantarkan impuls dari sel saraf ke sel saraf lainnya.



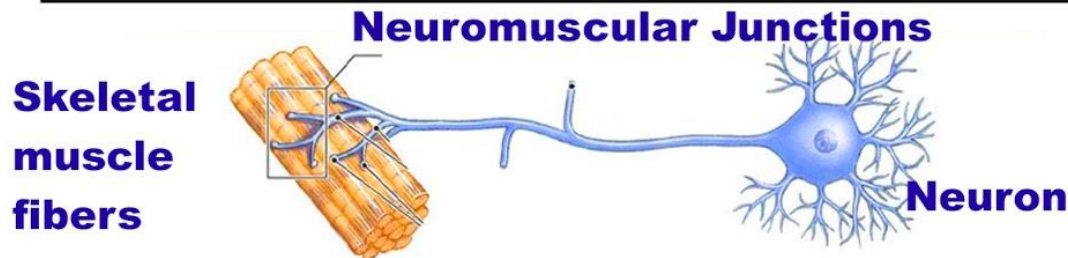
Hubungan neuron dengan sel lain

Types of Synapses

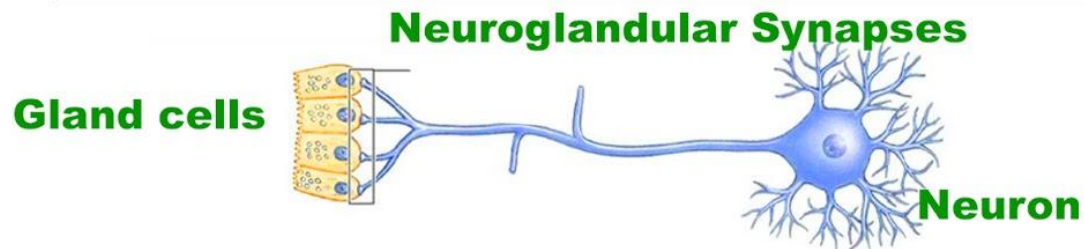
**Synapses with
another neuron**



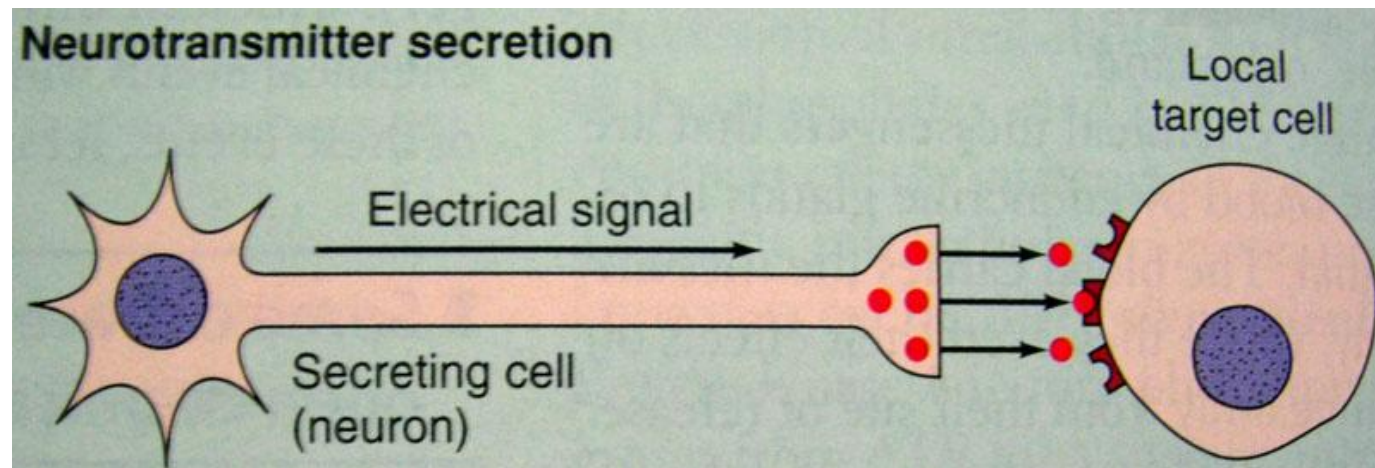
**Neuromuscular
Junctions**



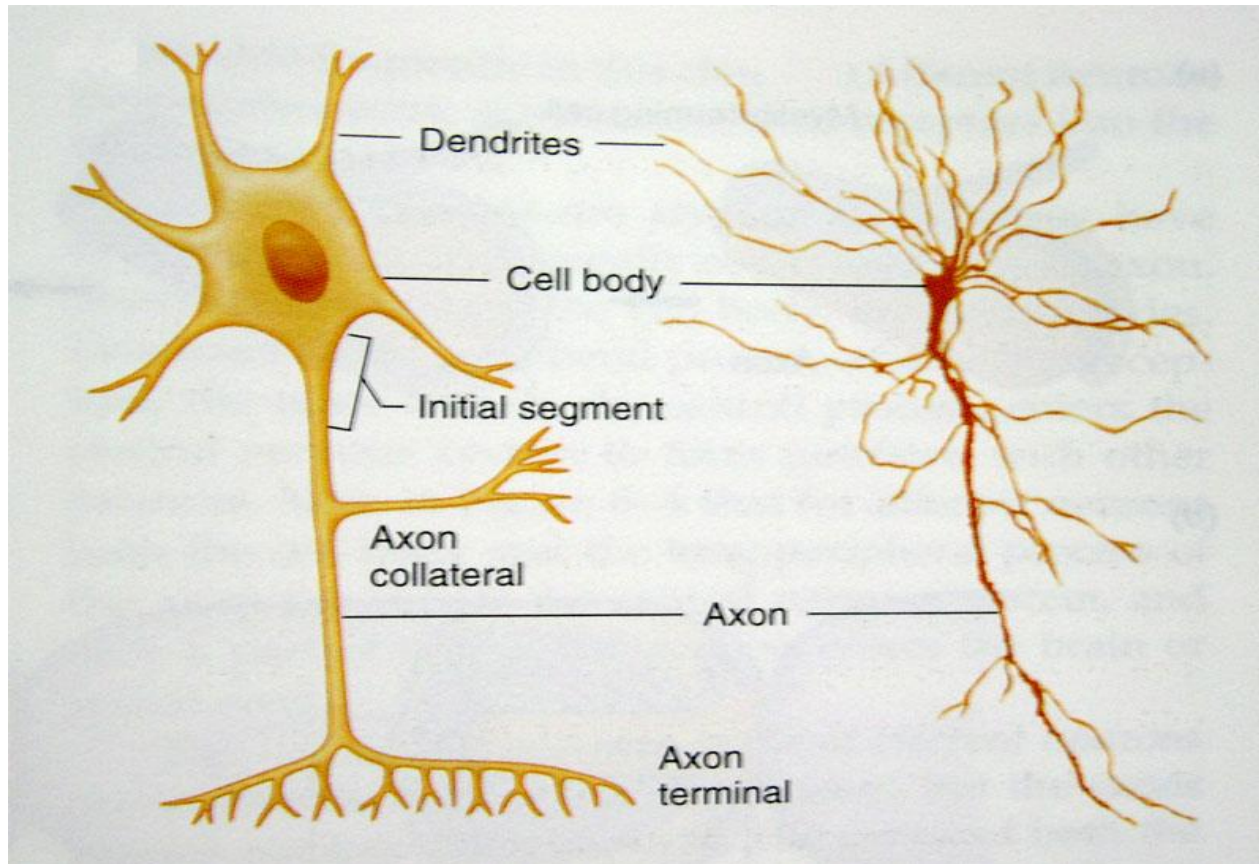
**Neuroglandular
Synapses**



Hubungan neuron dengan sel lain



Anatomi Neuron

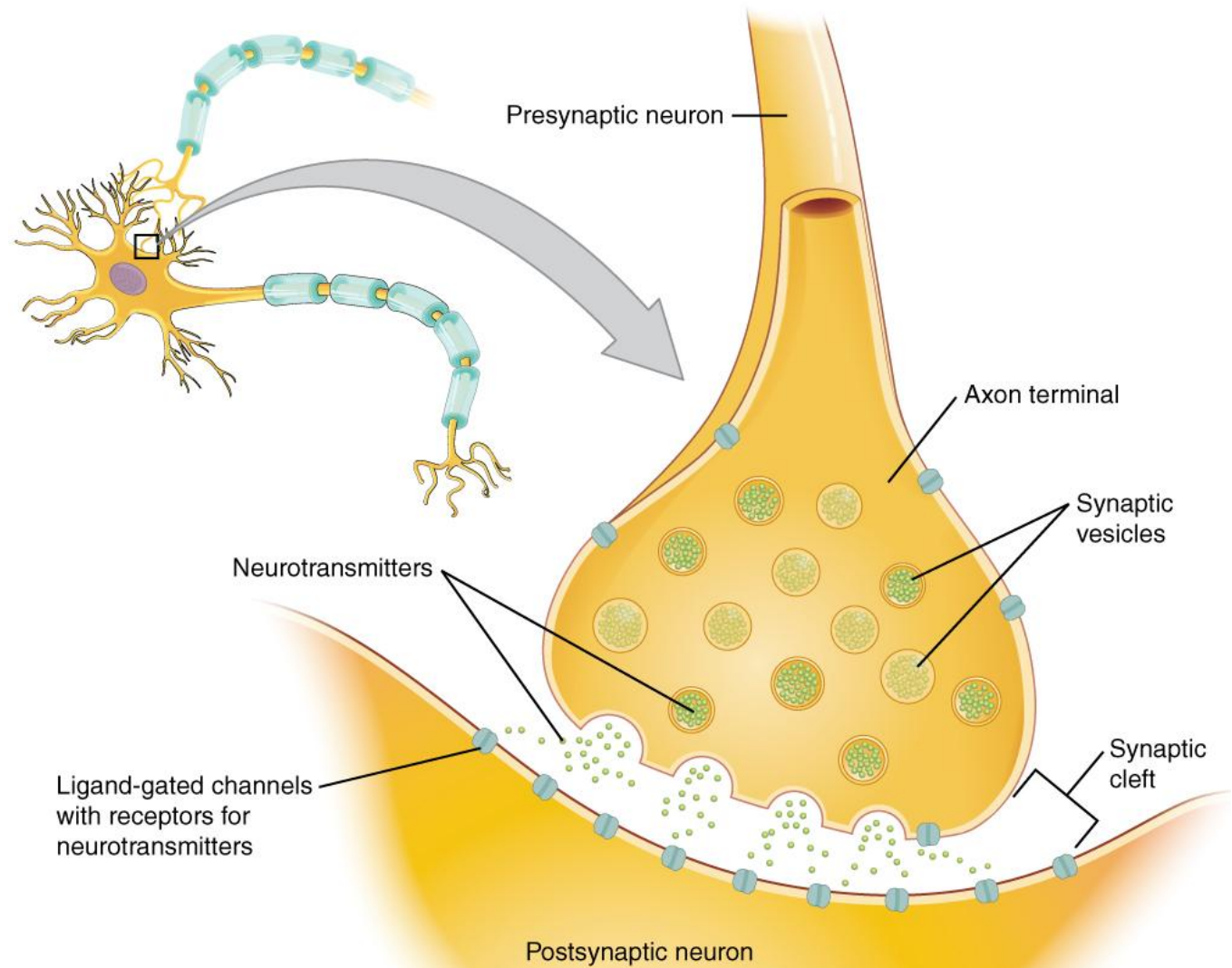




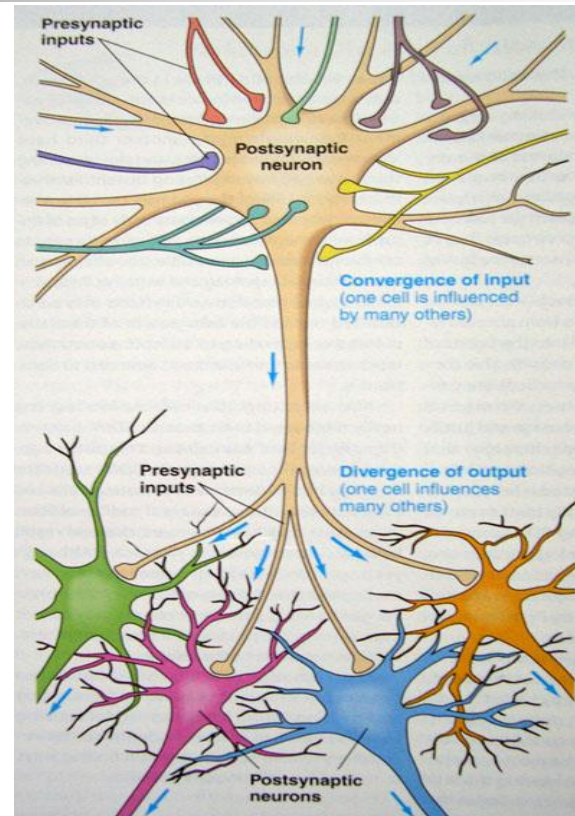
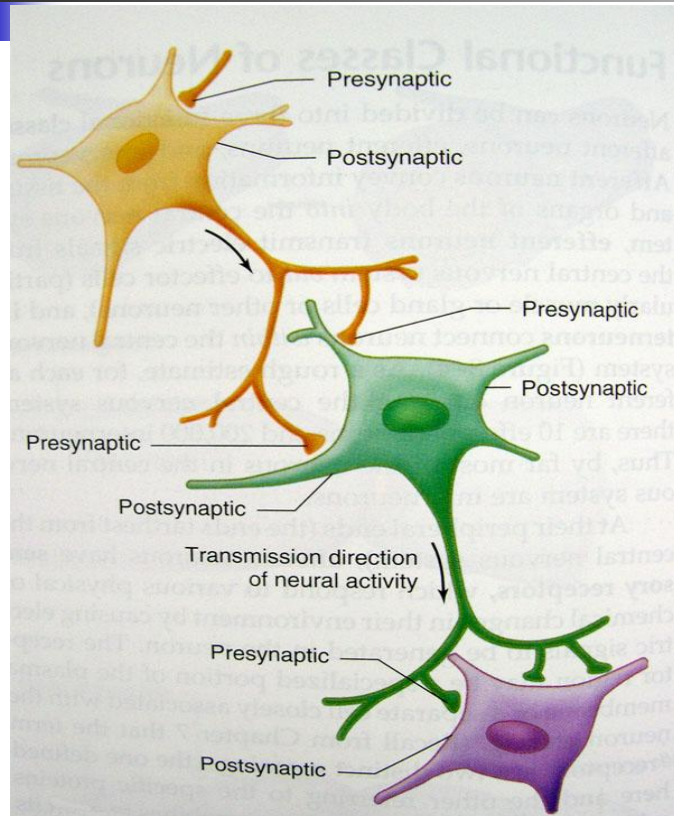
Anatomi sinaps

- Struktur yang terdapat pada sinaps adalah :
 - Sel presinaps
 - Celah sinaps
 - Sel postsinaps

Anatomy synaps



Anatomi sinaps

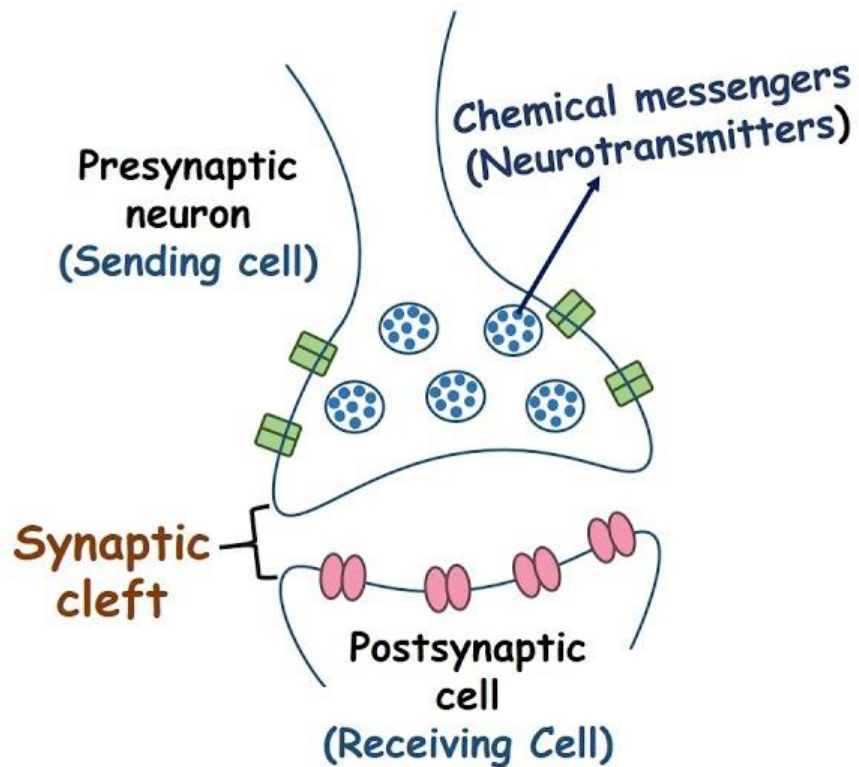




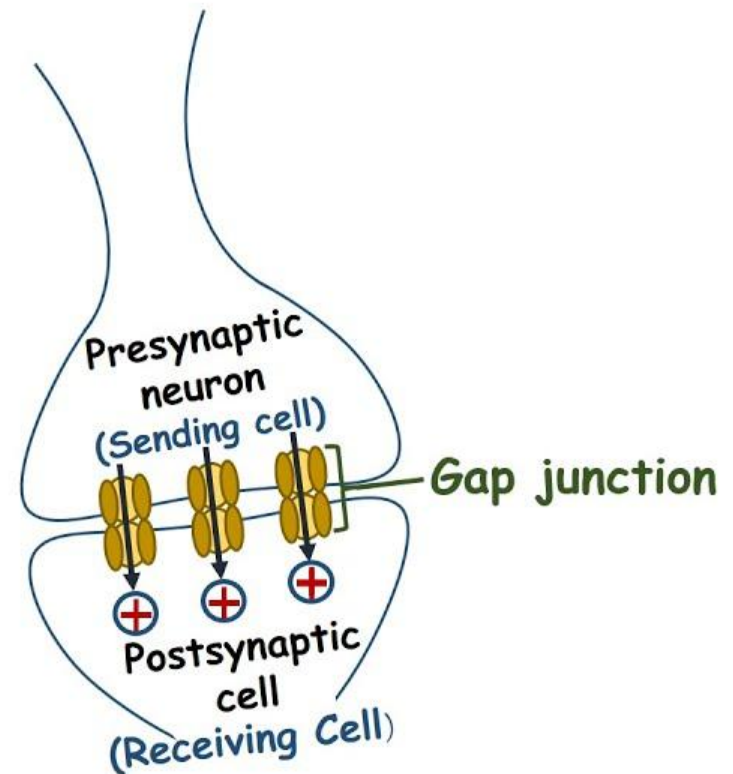
Klasifikasi sinaps

- Berdasarkan media penghantarnya :
 - Sinaps listrik (Gap junction)
 - Sinaps kimiawi, menggunakan neurotransmitter.
- Berdasarkan letak penempelan axon presinaps dengan sel postsinapsnya :
 - Akso-dendritik
 - Akso-somatik
 - Akso-aksonik

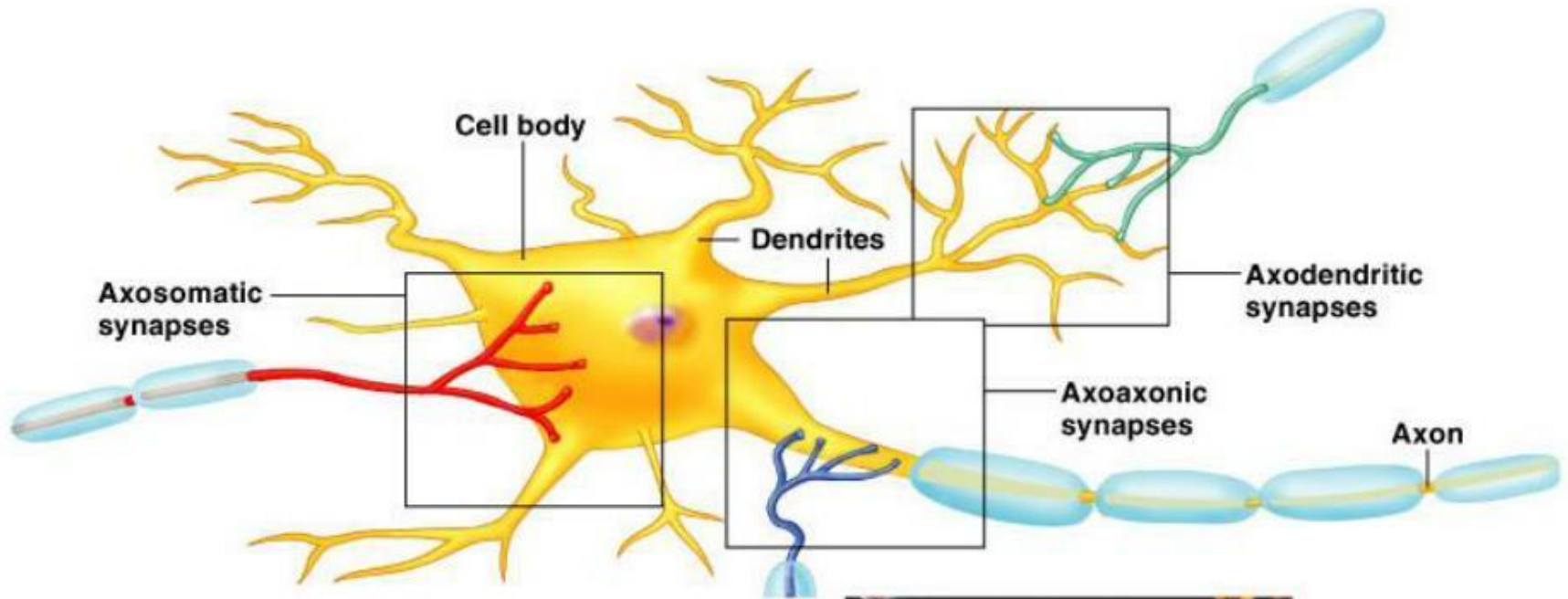
Chemical Synapse



Electrical Synapse

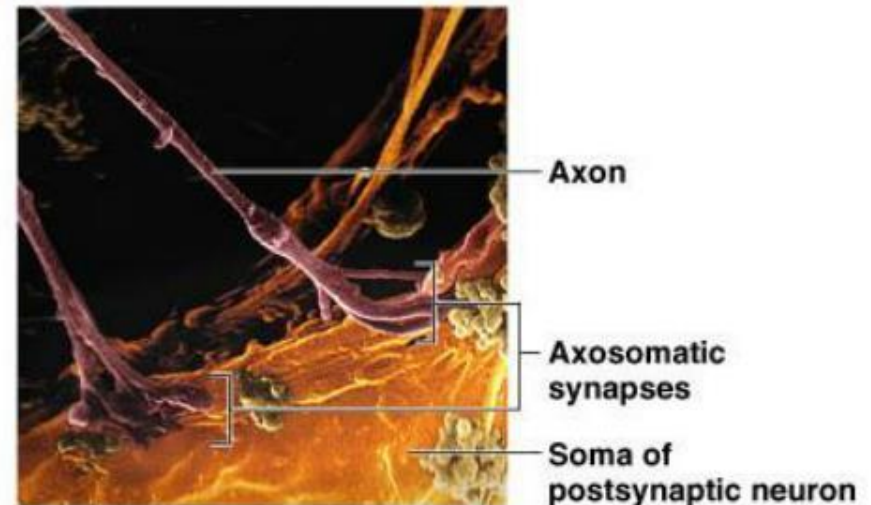


Synapses

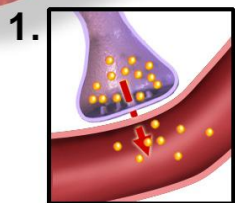
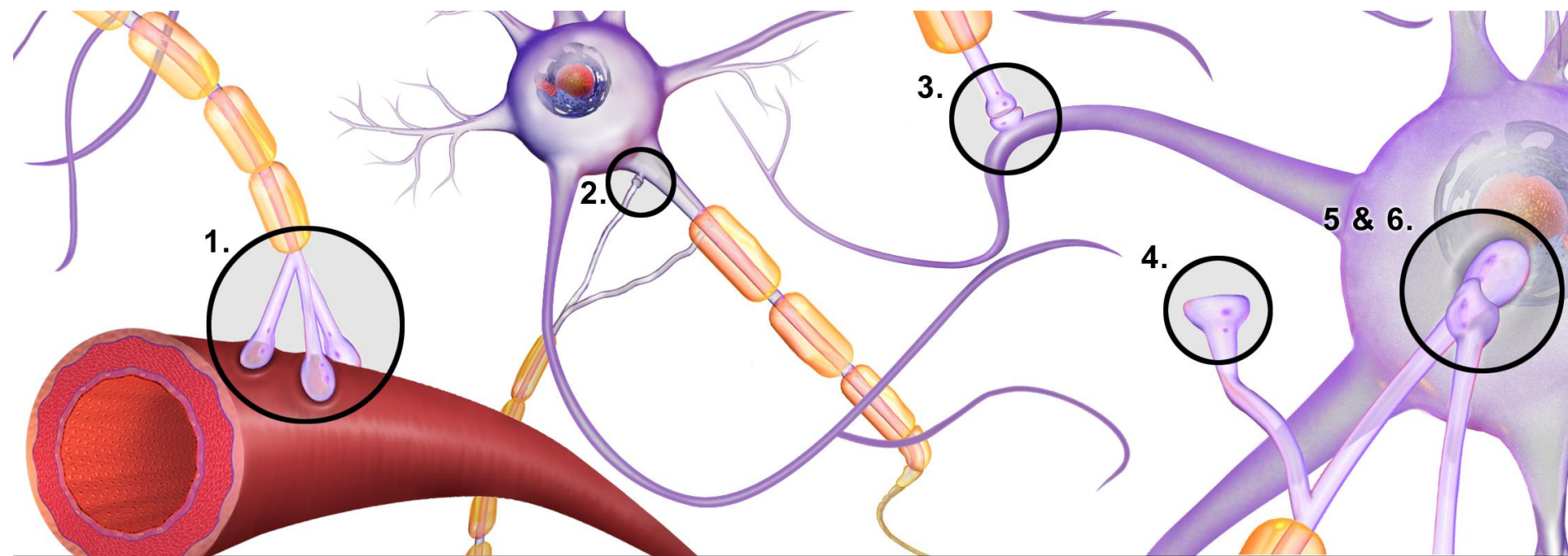


(a)

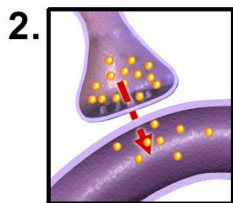
1. Axodendritic synapse
2. Axosomatic synapse
3. Axoaxonic synapse



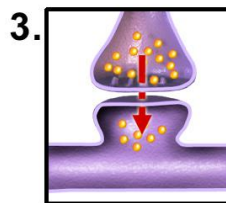
(b)



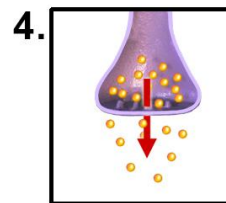
Axosecretory
Axon terminal
secretes directly
into bloodstream



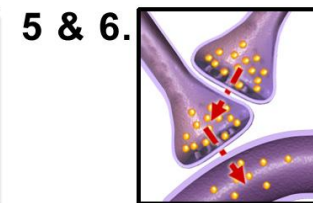
Axoaxonic
Axon terminal
secretes into
another axon



Axodendritic
Axon terminal
ends on a dendrite
spine



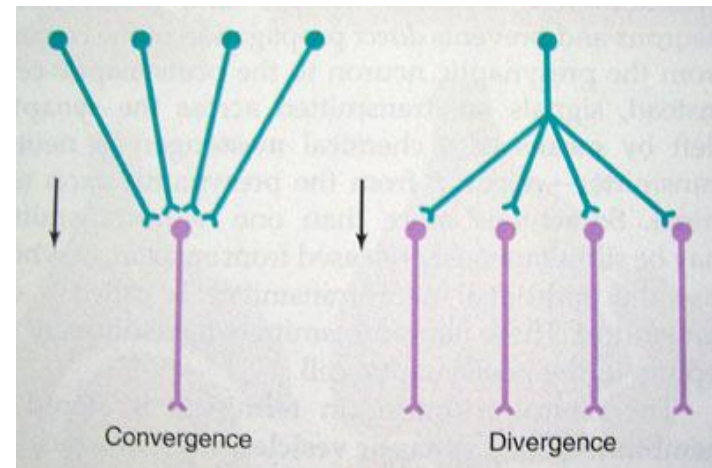
Axoextracellular
Axon with no
connection
secretes into
extracellular fluid



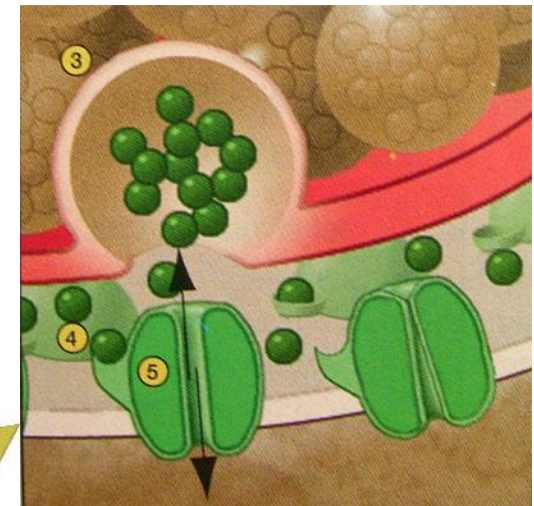
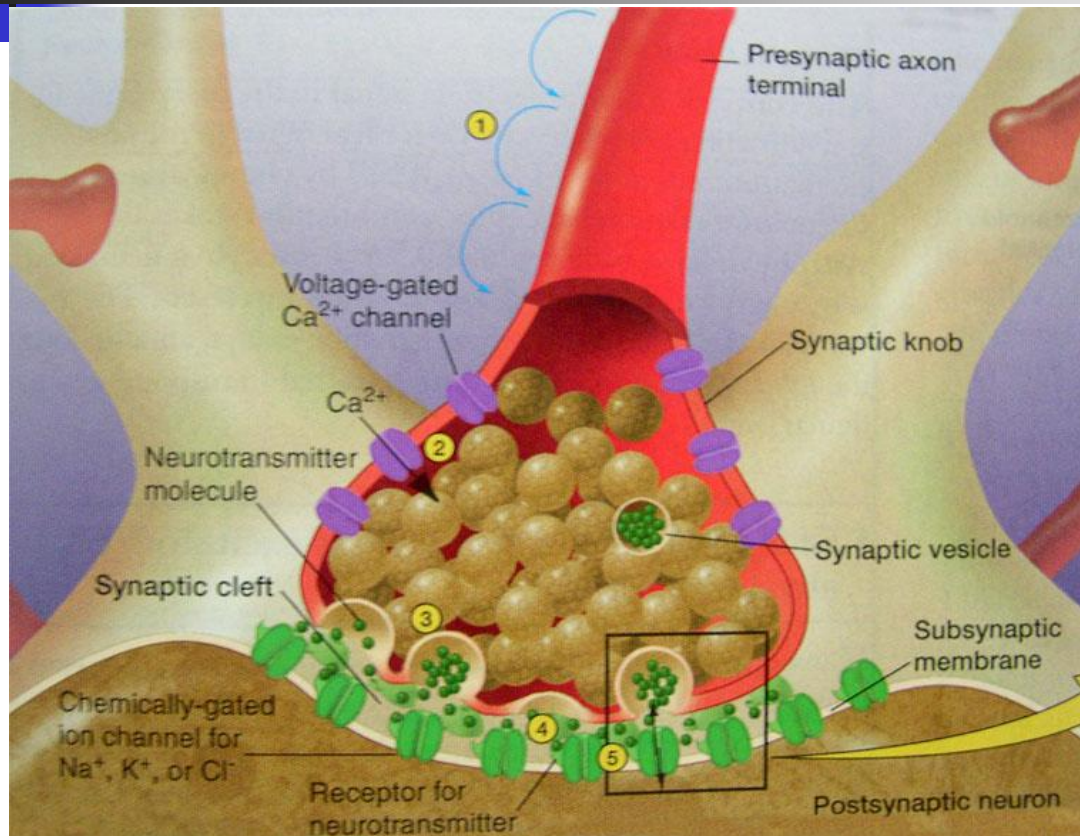
Axosomatic
Axon terminal
ends on soma
Axosynaptic
Axon terminal
ends on another
axon terminal

Klasifikasi sinaps

- Berdasarkan sifat hubungan antara presinaps dengan postsinapsnya :
 - Sinaps konvergen
 - Sinaps divergen



Fisiologi sinaps





Fisiologi sinaps

A

Synaptic knob

C

Ca²⁺ influx

B

Potential changes in postsynaps

D

Releasing of neurotransmitter

E

Exocitosis

F

Presynaptic Impuls

G

Opening of specific ion channel

H

Receptor + Neurotransmitter
Binding

I

Opening Ca²⁺ channel

Answer



Potensial postsinaps

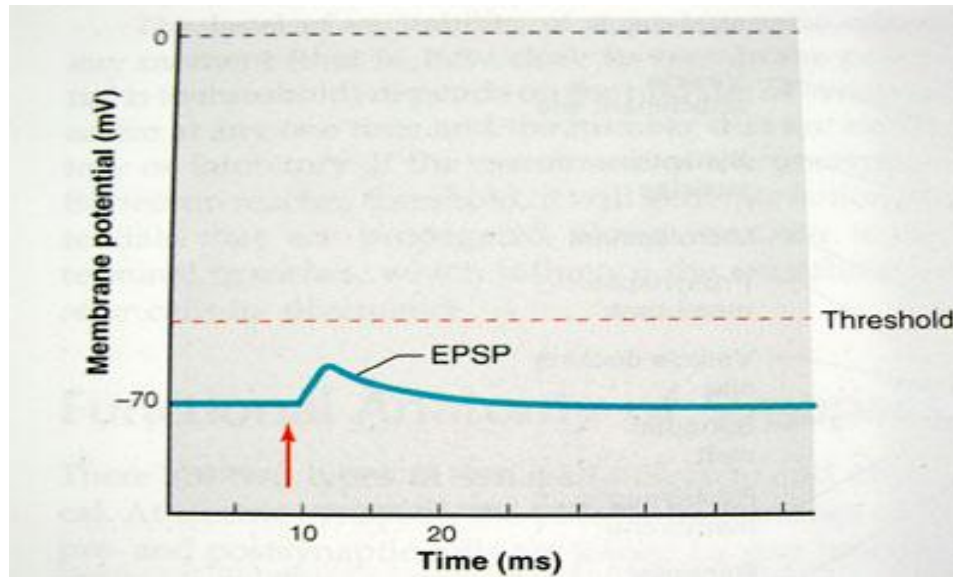
- Potensial yang terbentuk pada sel postsinaps setelah terjadi perubahan permeabilitas pada membrannya yang disebabkan oleh ikatan neurotransmitter dengan reseptornya.
- Jenis :
 - EPSP (*Excitatory Postsynaptic Potential*)
 - IPSP (*Inhibitory Postsynaptic Potential*)



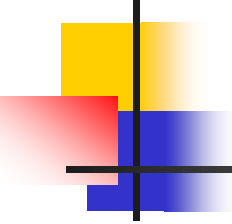
EPSP

- Bila terjadi peningkatan permeabilitas terhadap ion Na^+
- Depolarisasi $\rightarrow$ Muatan membran sel postsinaps lebih (+)
- Ditimbulkan oleh neurotransmitter yang bersifat "*excitatory*"

EPSP



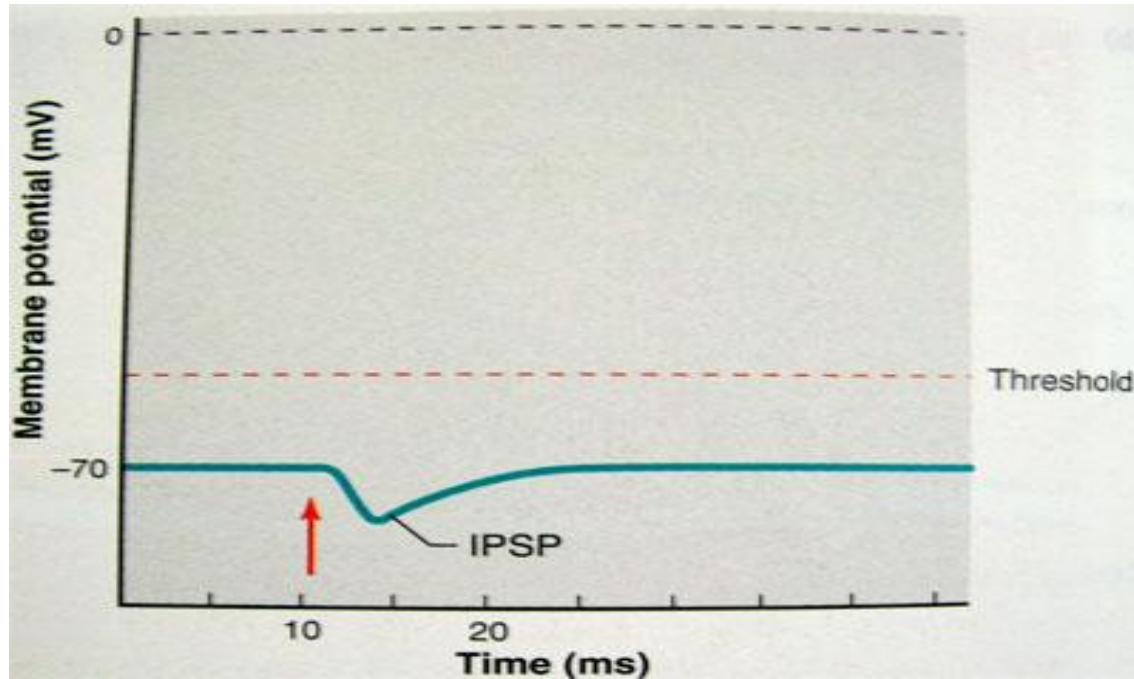
- Slow EPSP ? Jelaskan !



IPSP

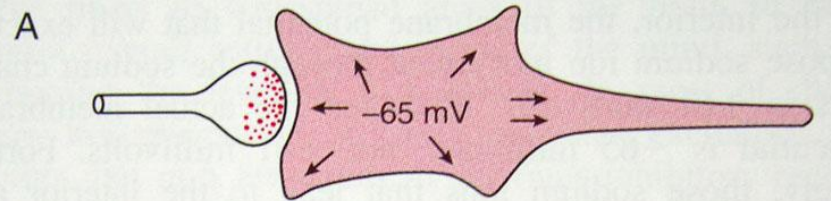
- Bila terjadi peningkatan permeabilitas membran sel postsinaps terhadap ion Cl^-
- Hiperpolarisasi $\longrightarrow$ Muatan membran sel postsinaps lebih (-)
- Ditimbulkan oleh neurotransmitter yang bersifat “*Inhibitory*”

IPSP

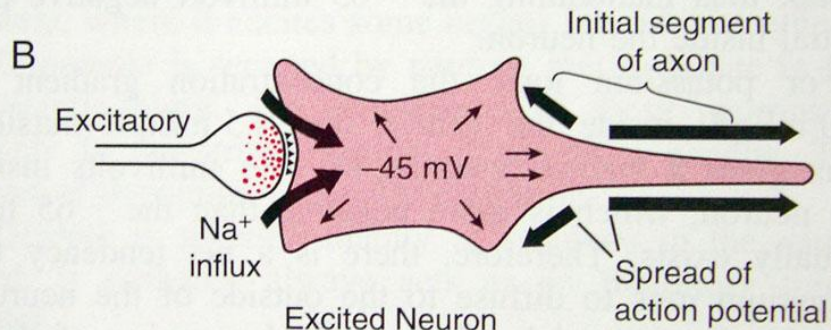


- Slow IPSP ?

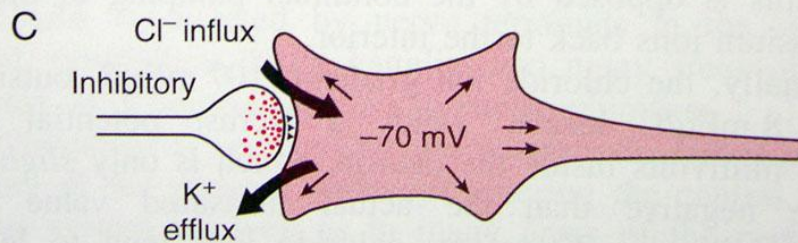
EPSP + IPSP



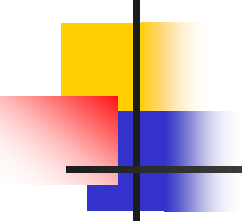
Resting Neuron



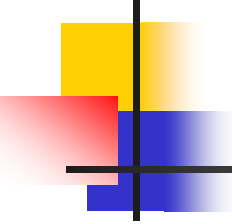
Excited Neuron



Inhibited Neuron

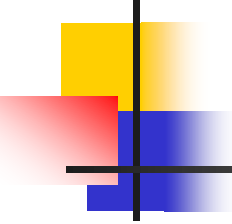


Respon yang timbul pada postsinaps
tergantung pada jenis neurotransmitter
dan jenis reseptornya



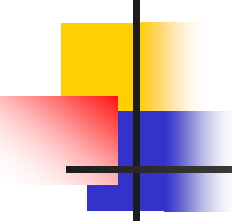
Pencetusan Potensial Aksi

- Total EPSP + IPSP pada suatu waktu → GPSP
- $GPSP \geq$ ambang letup → Potensial aksi
- Dimana potensial aksi pertama kali tercetus? Mengapa?
- Potensial aksi dihantarkan kemana?
- Impuls antidromik?



Reminder

- Potensial postsinaps tidak mengikuti hukum ALL or None
- Potensial aksi mengikuti hukum All or None
- Potensial aksi berjalan 1 arah pada neuron, mengapa?
- Potensial aksi berjalan 1 arah pada sinaps, mengapa?
- Perubahan yang terjadi pada postsinaps tergantung dari jenis neurotransmitter dan jenis reseptornya.



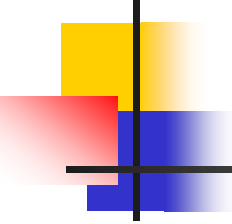
Proses yang mempengaruhi pencetusan potensial aksi

- Fasilitasi :

Proses yang mempermudah terjadinya potensial aksi pada sel postsinaps

- Inhibisi :

Proses yang menghambat terjadinya potensial aksi

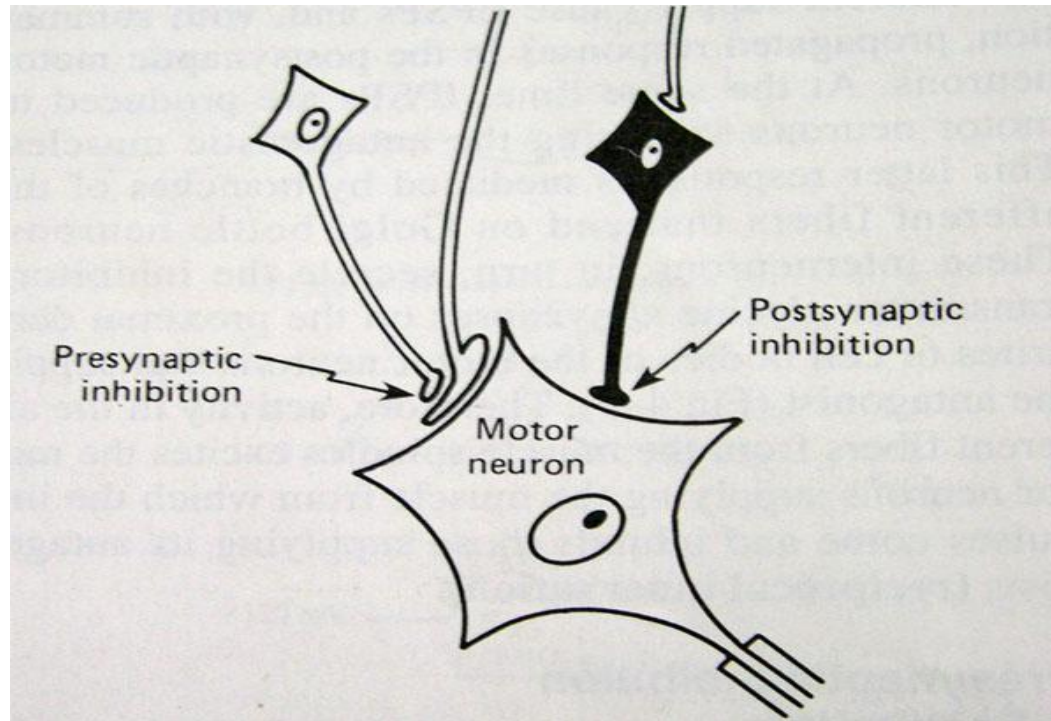


Inhibisi

- Inhibisi postsinaps :
 - Direk / langsung → IPSP → melalui interneuron
 - Indirek / tidak langsung → masa refrakter, masa after hiperpolarization
- Inhibisi presinaps
melalui struktur *presynaptic synapse*.

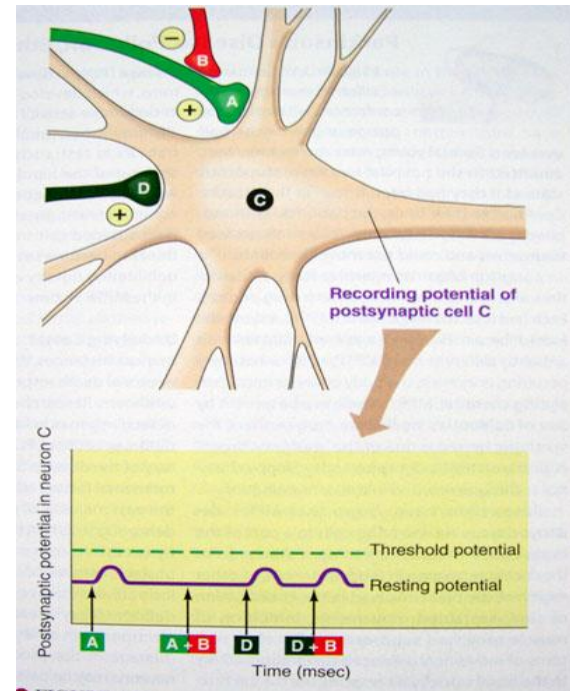
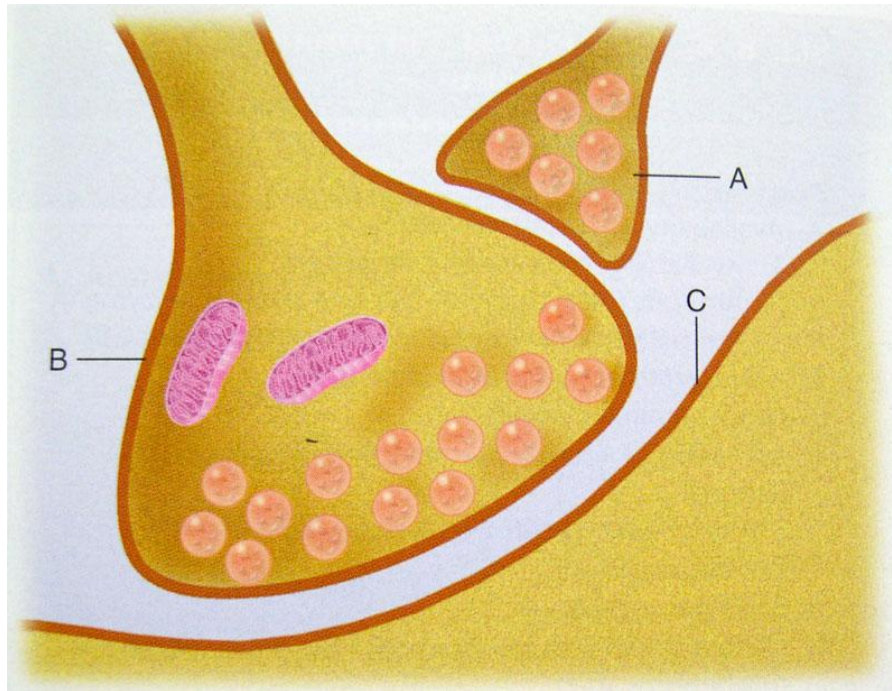
Inhibisi Postsinaps

- Gambar inhibisi postsinaps



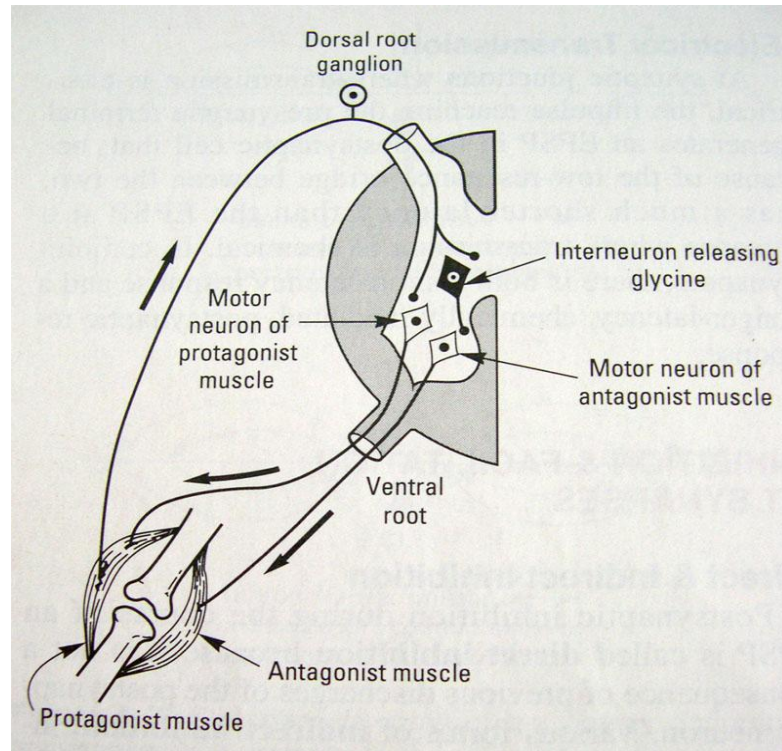
Inhibisi presinaps

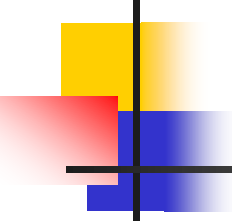
■ Gambar inhibisi presinaps



Persarafan resiprokal

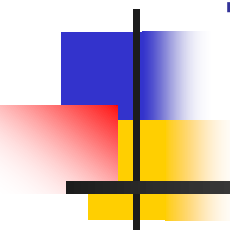
- Gambar persarafan resiprokal





Obat-obat yang mempengaruhi hantaran sinaps

- Caffein & Theofilin
- Anestetika lokal
- Curare



Thank you

Department of Physiology
Trisakti University
Jakarta