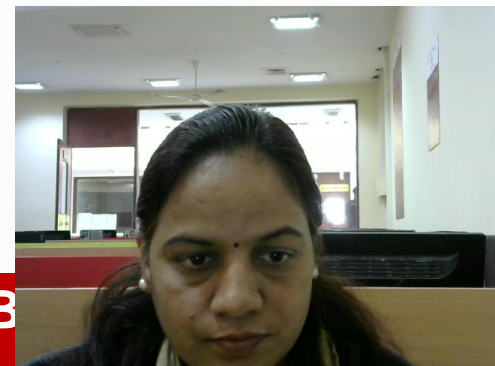


Resting potential, action potentials,
synaptic potentials,

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Cell Membrane

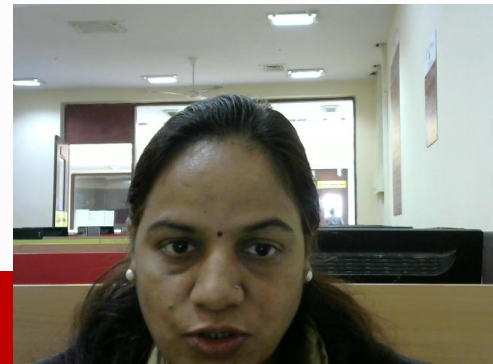
Chemical composition and its structural plan

- Model of cell membrane: Fluid Mosaic Model
- Membrane fluidity. Functions of cell membrane
- Physiology



ACTION POTENTIAL & SYNAPSE

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video

Microsoft Teams

BIOLOGY FOR ENGINEERS

2020-12-02 11:11 UTC

Recorded by

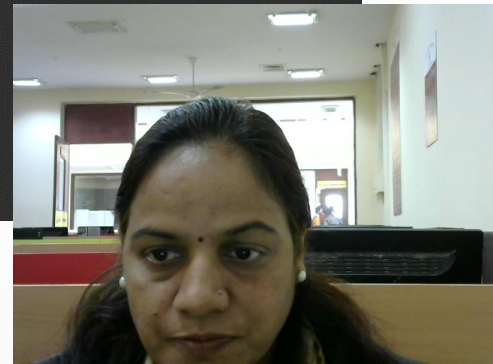
Meenakshi Singh-
GU0113210114

Organised by

Meenakshi Singh-
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Channel

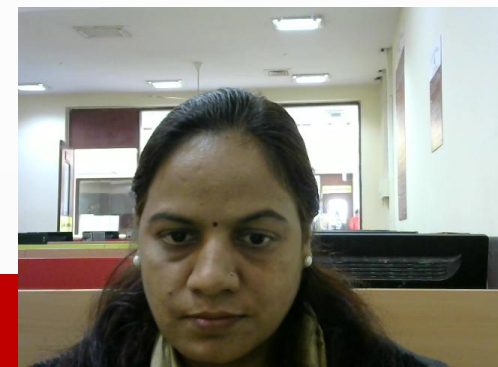
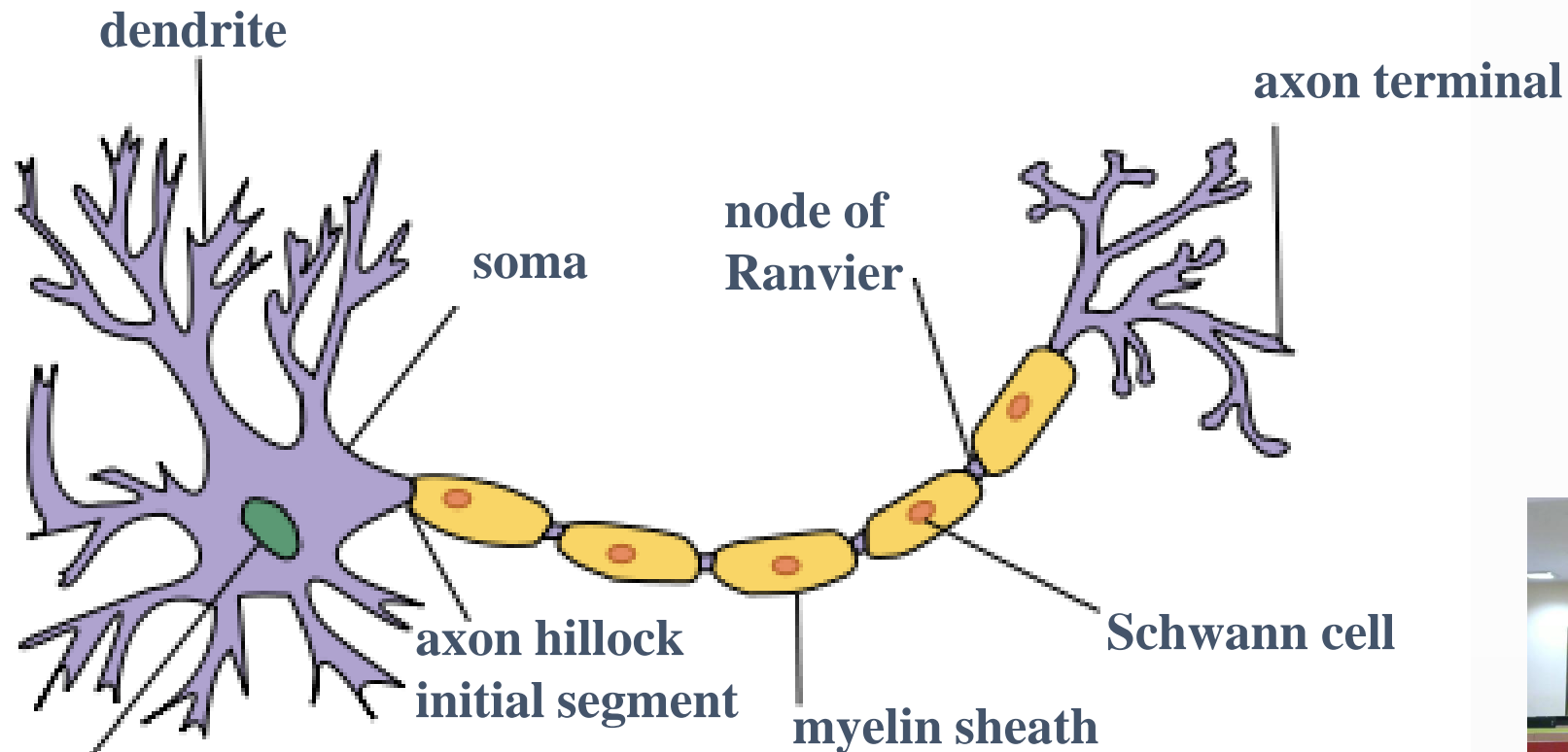
BBS01T1008 - Biology
for Engineers



NEURON

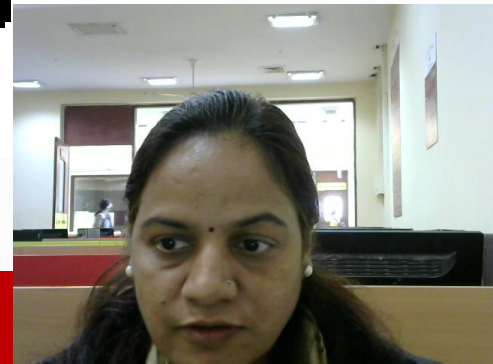
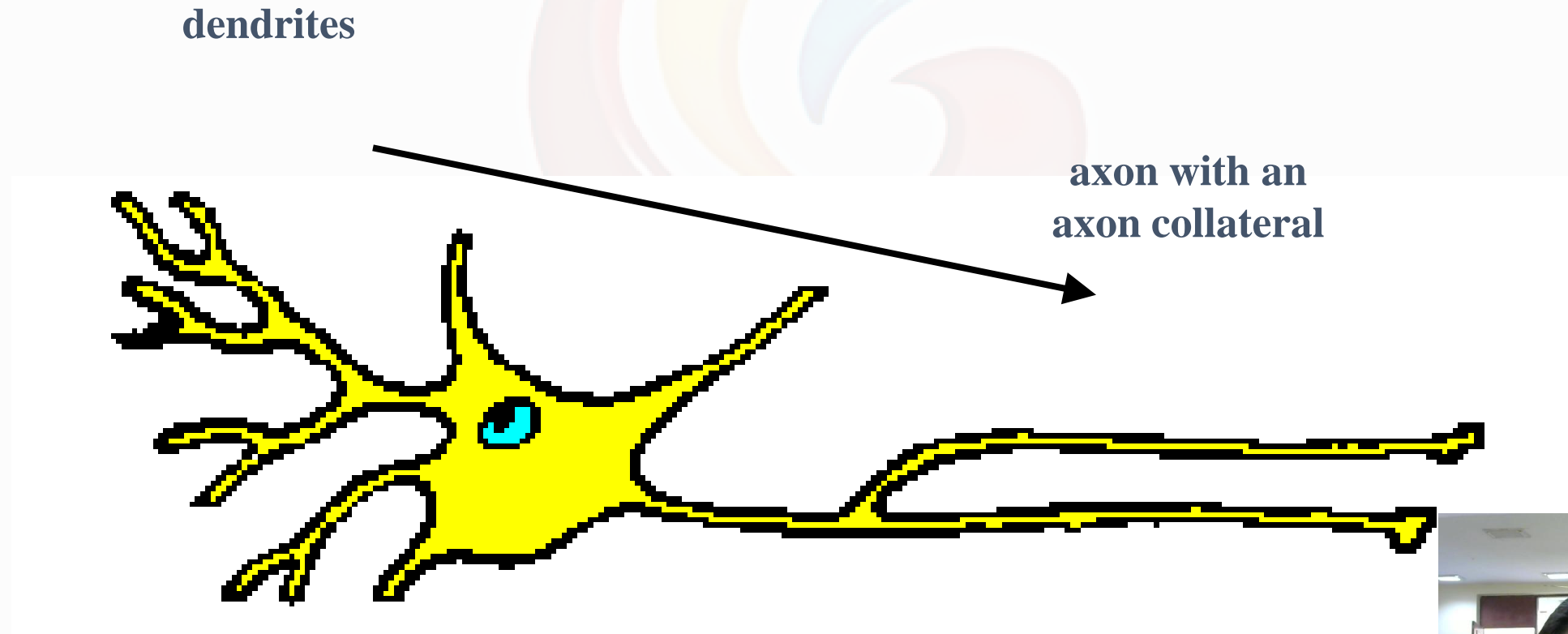
Excitable tissues - neuron (nerve tissue)
- muscle fiber (muscle tissue)

Neuron - primary structural and functional unit of nerve tissue
(brain, spinal cord, nerves, sensory cells)



NEURON

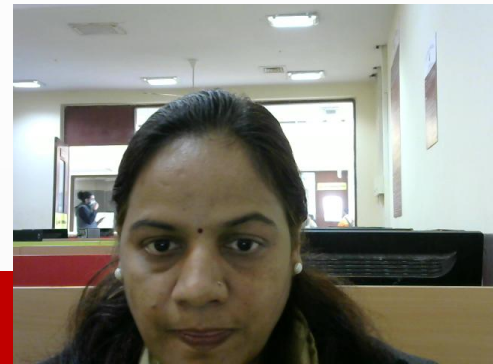
Propagation of neuronal excitation from dendrites to the
axon



Membrane potential,

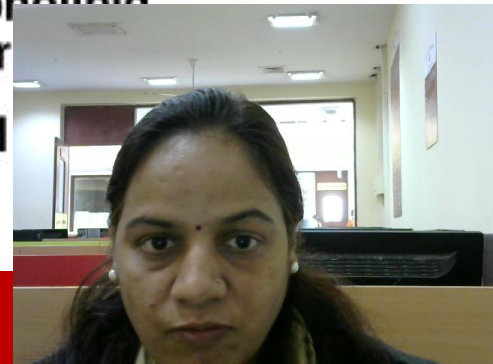
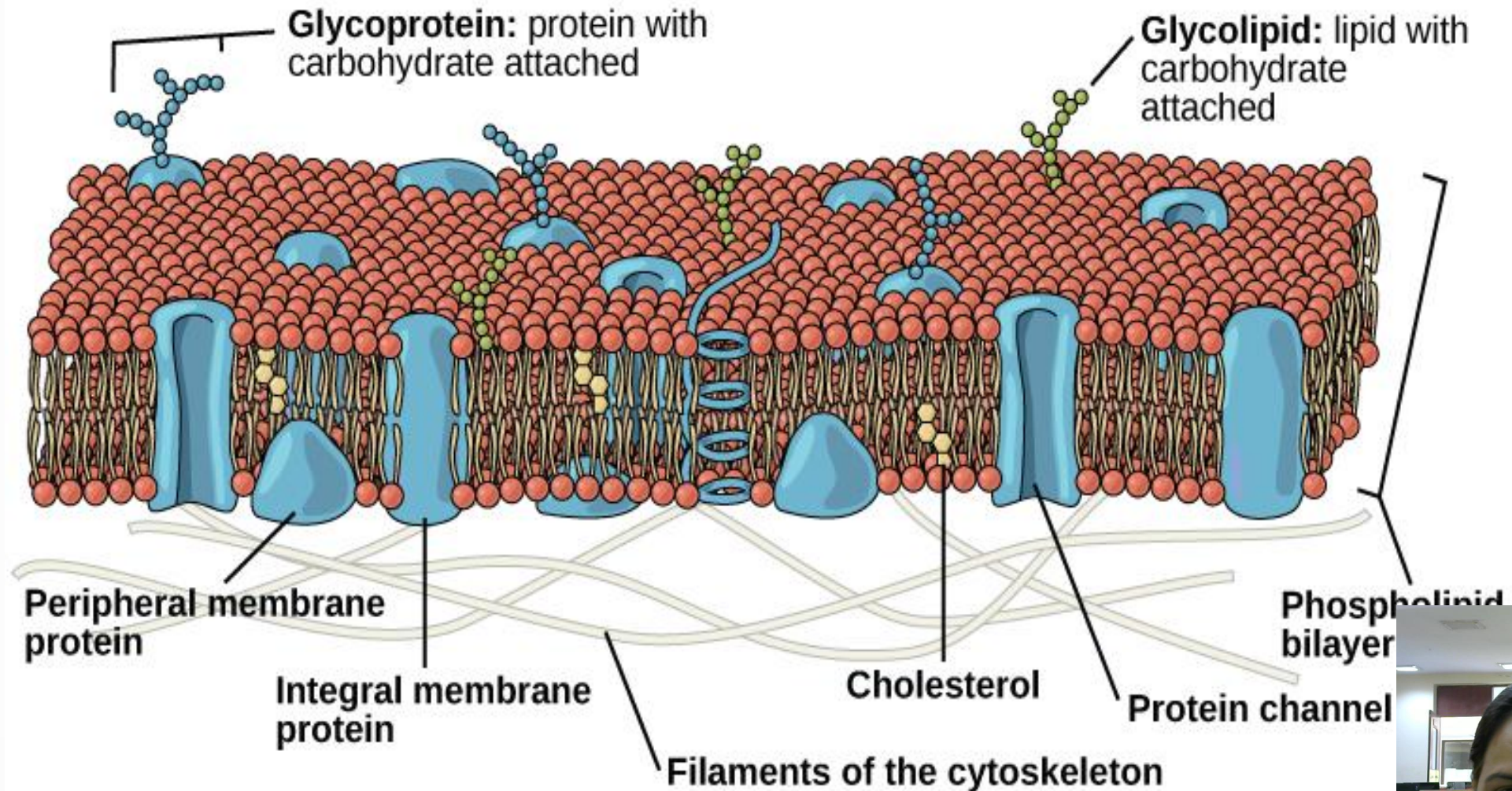
**Membrane potential,
membrane depolarization,
hyperpolarization**

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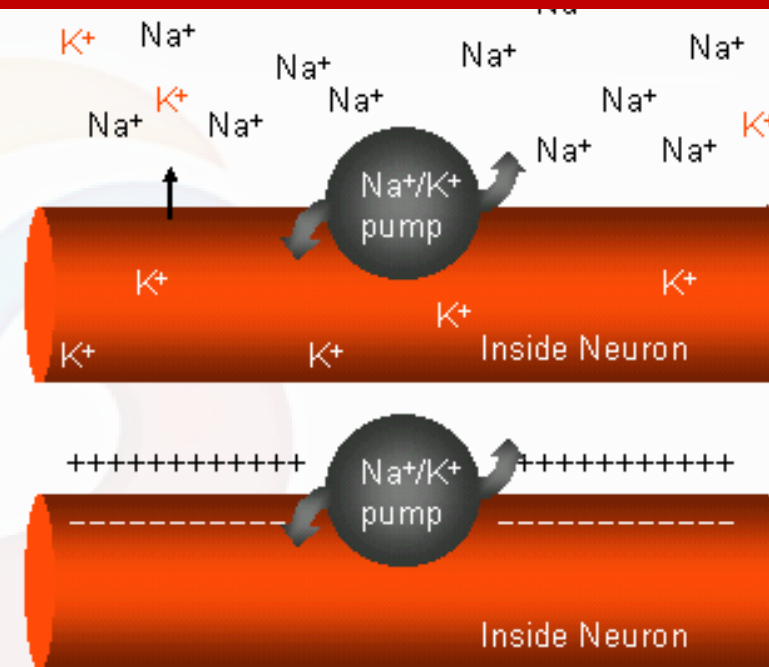
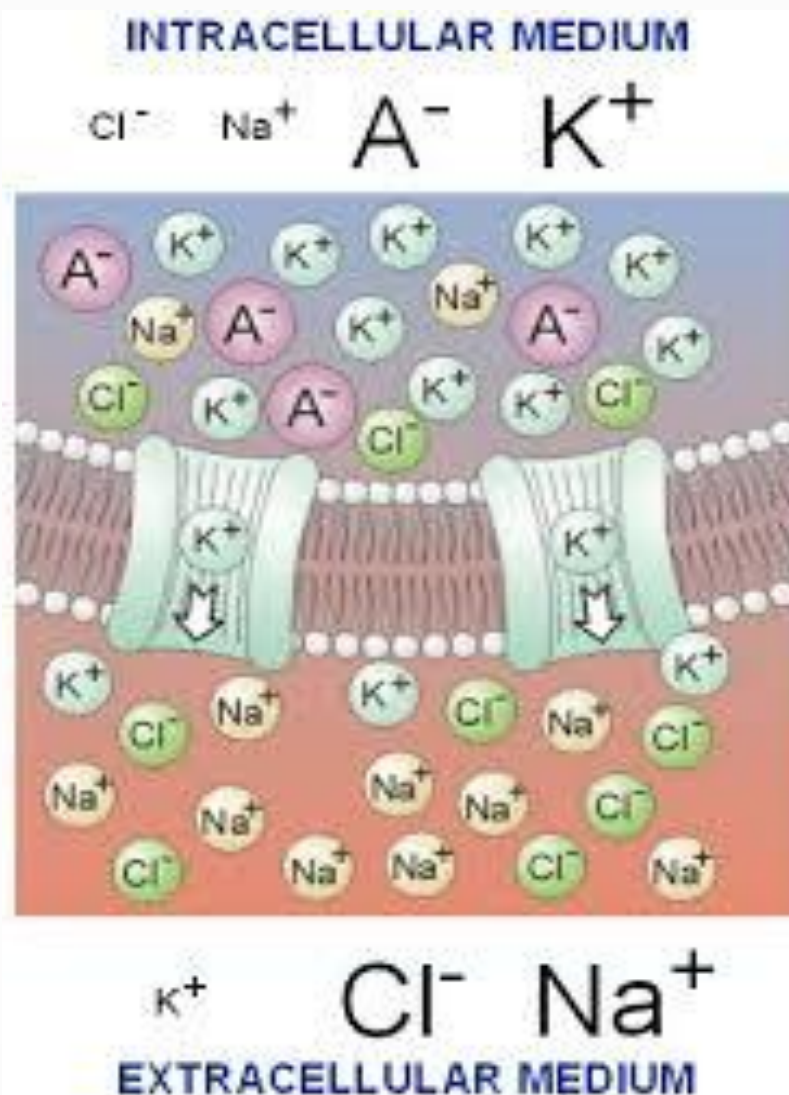


Cell membrane

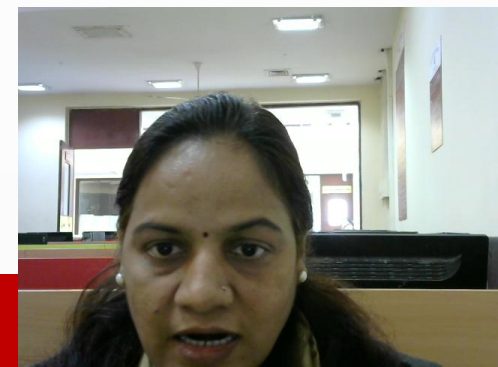
- double-layer of phospholipide + cholesterol + proteins



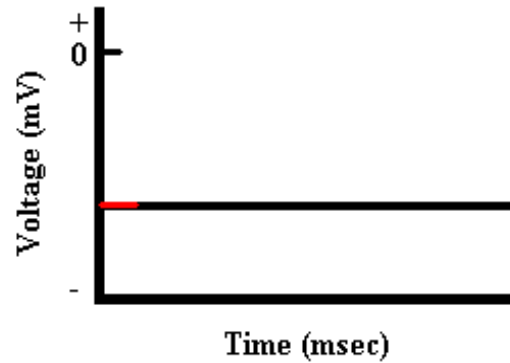
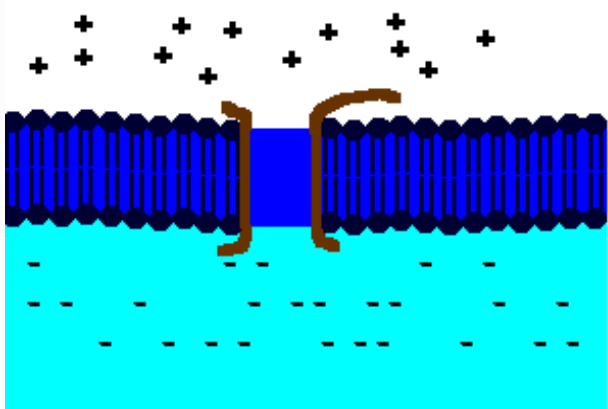
INTRA & EXTRA-CELLULAR ION CONCENTRATIONS



ion	inside	outside (e.g. plasma)
Na^+	12 mM	145 mM
K^+	140 mM	4 mM
Cl^-	4 mM	115 mM
HCO_3^-	12 mM	30 mM
protein ⁻	140 mM	10 mM
Ca^{++}	0,0001 mM	2 mM



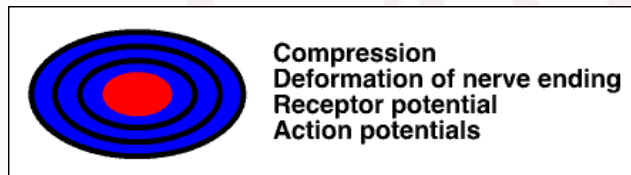
membrane potential



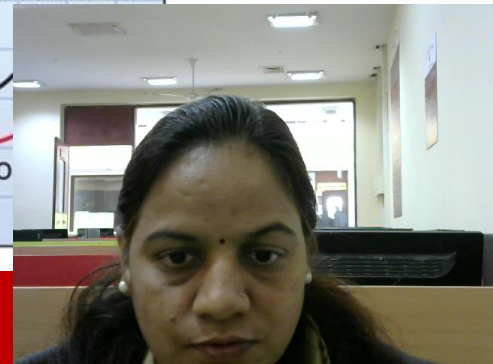
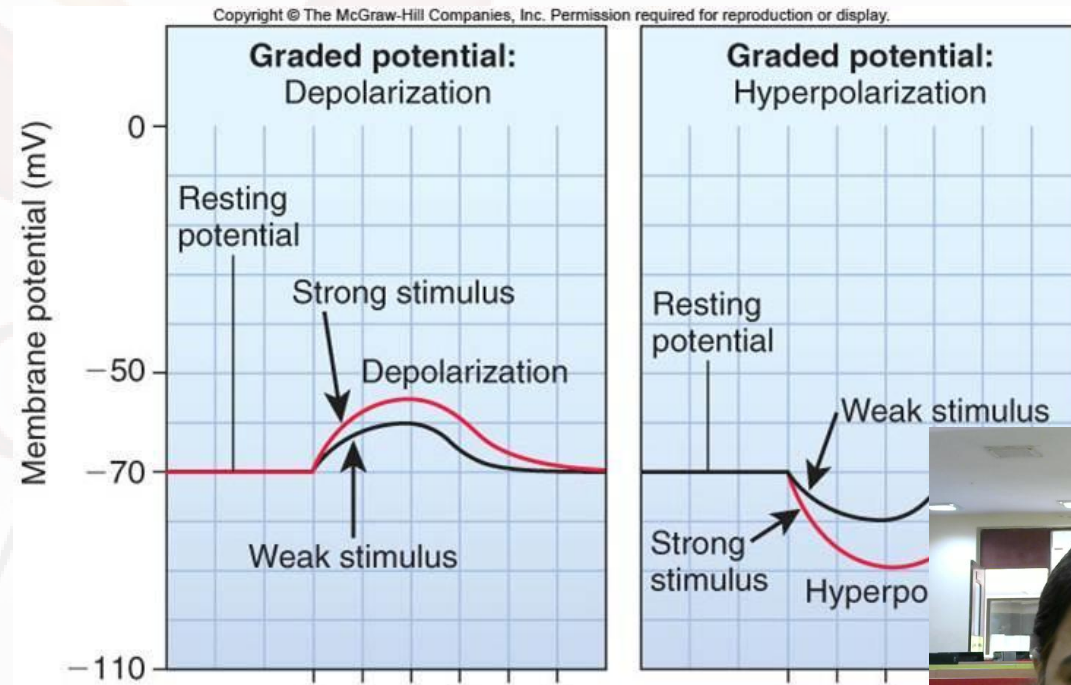
Hyperpolarization –
magnitude of membrane
- more polarization =
increased magnitude
of membrane
potential
(e.g. from -70 mV to -80 mV)

**Graded (local) responses =
graded depolarizations
or hyperpolarizations :**

- electricity
- chemicals
- generator potential (sensory)



- synaptic
EPSP (depolarization)



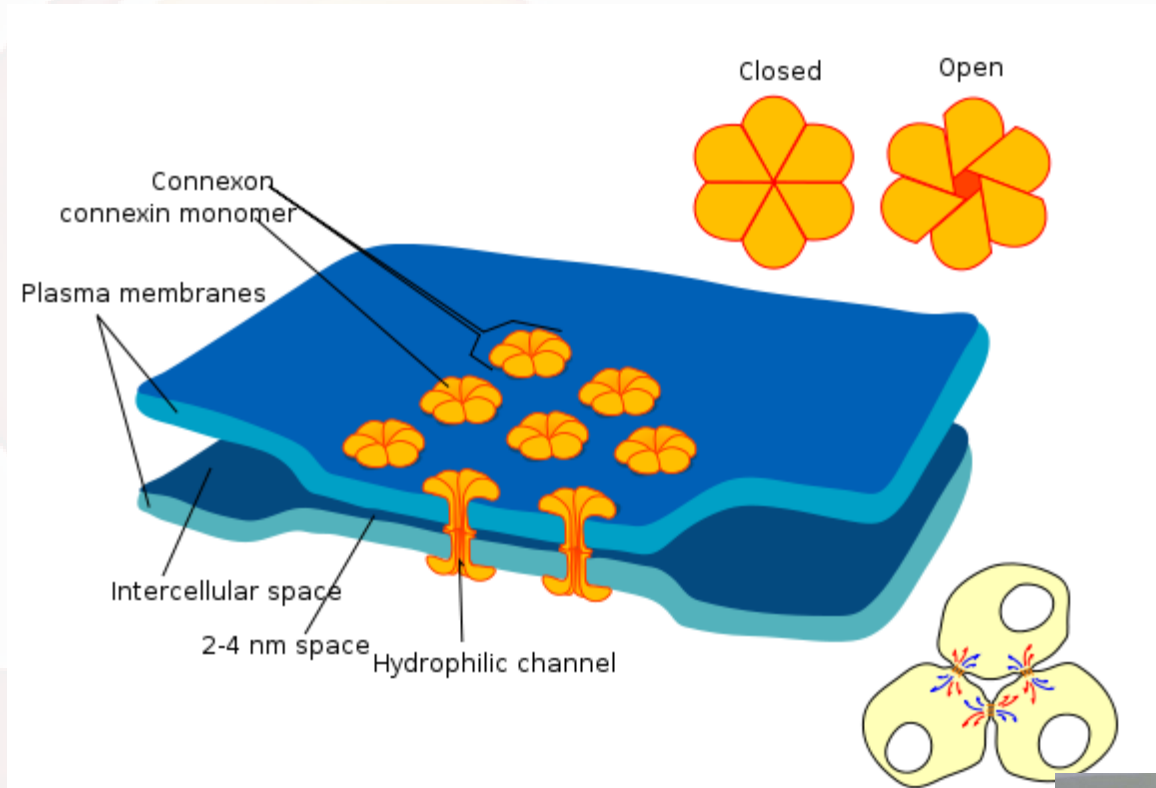
Electric signal & synapse

neurons signal to each other or to muscles or glands

- **Electrical**

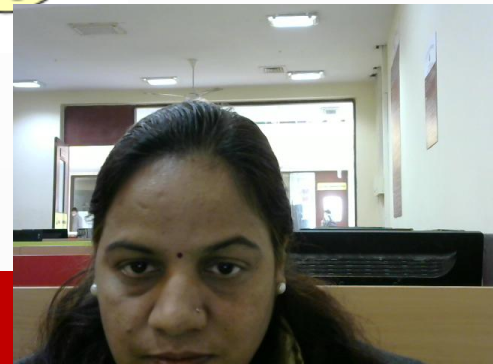
- synapses**

- electric signal goes through „gap junction“ (bidirectional)

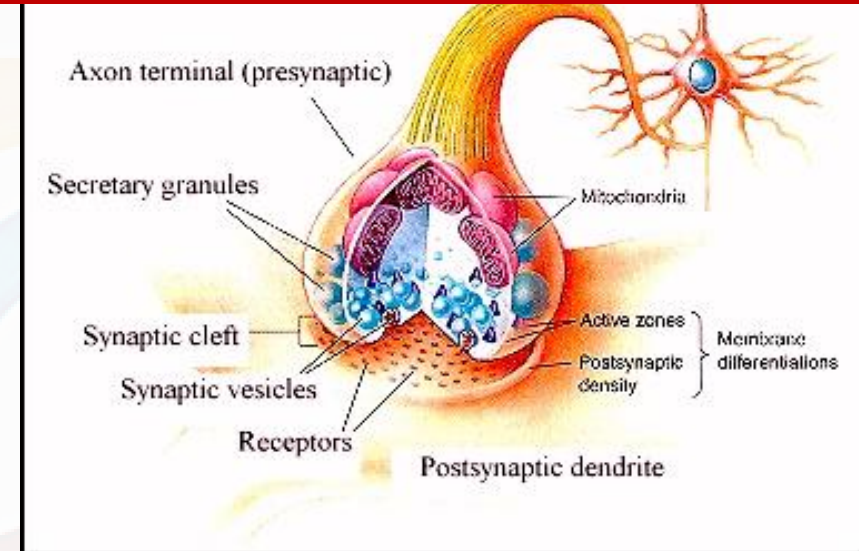
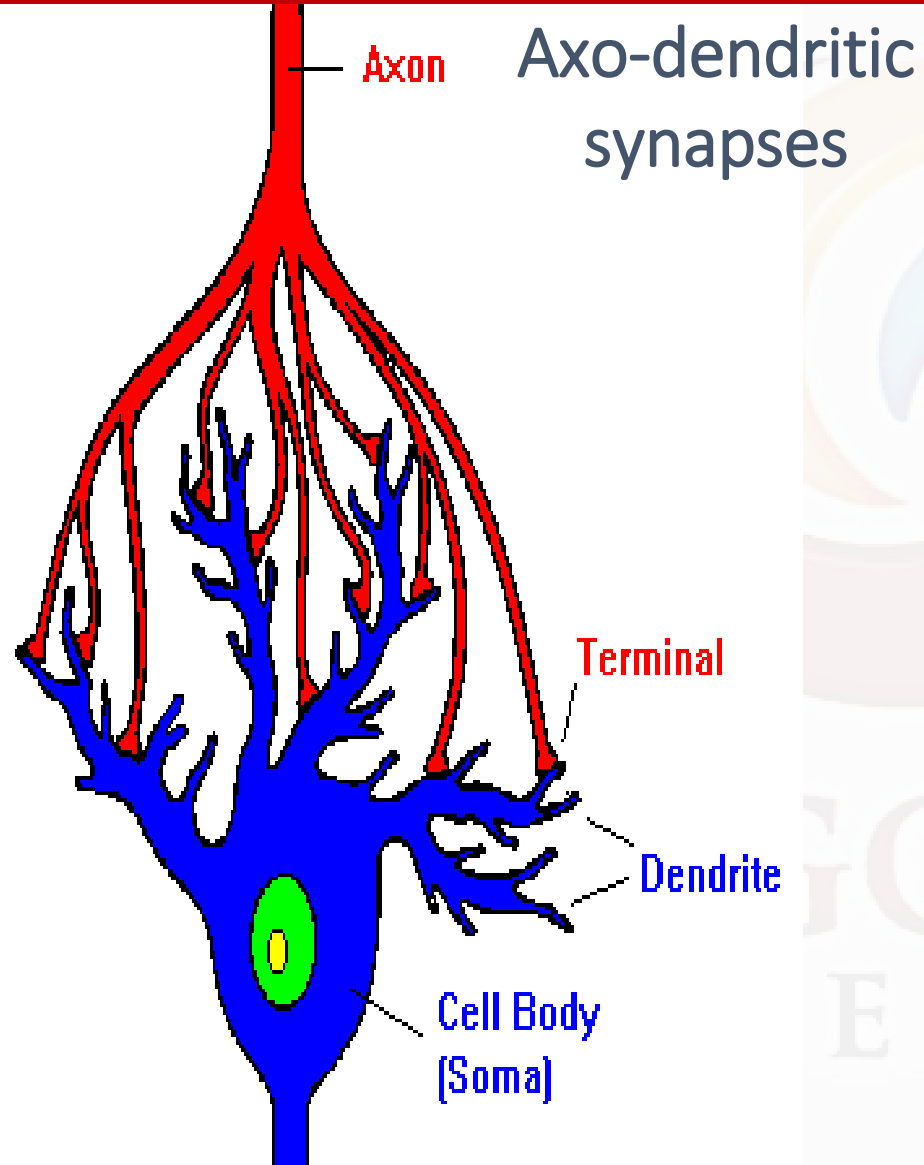


- **Chemical synapses** – chemical transmission (one-way)
one-directional from a presynaptic to a postsynaptic cell

1 mm³ of human cerebral cortex - about a billion of synapses

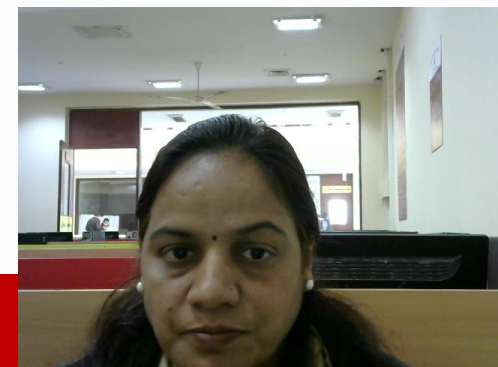


synapses

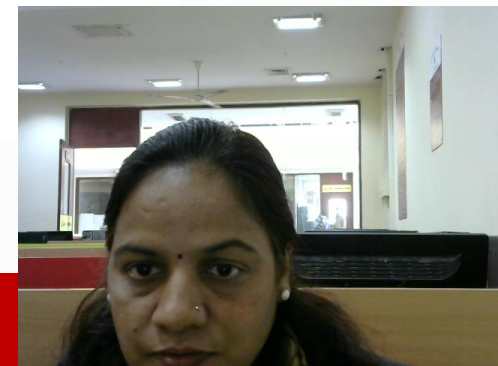
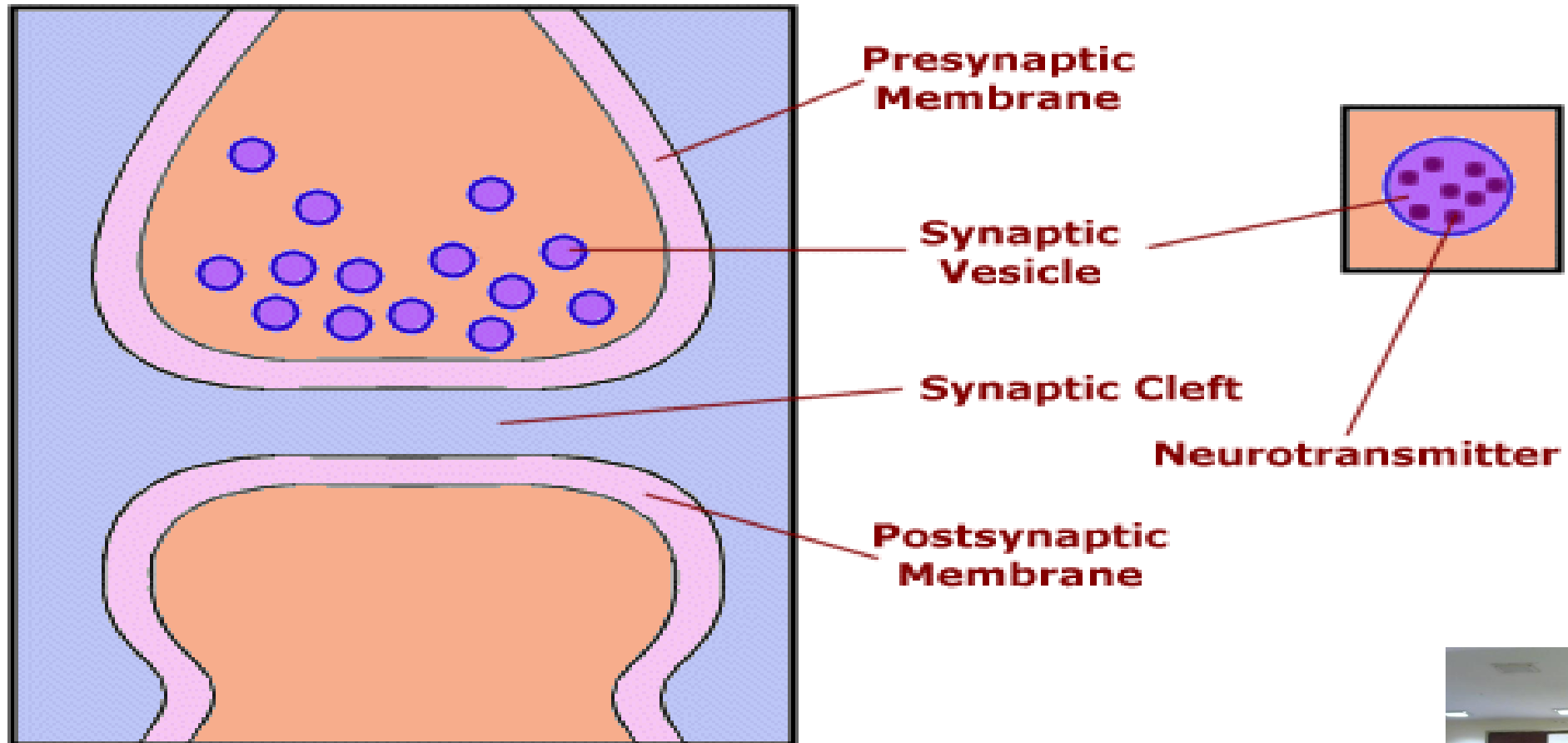


Synapses:

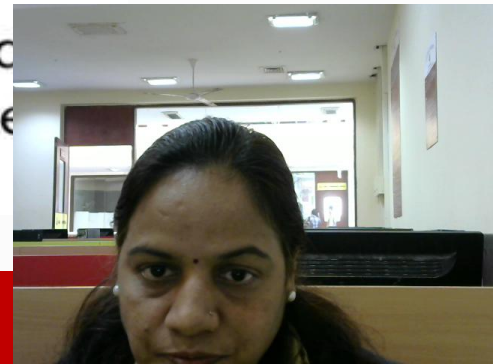
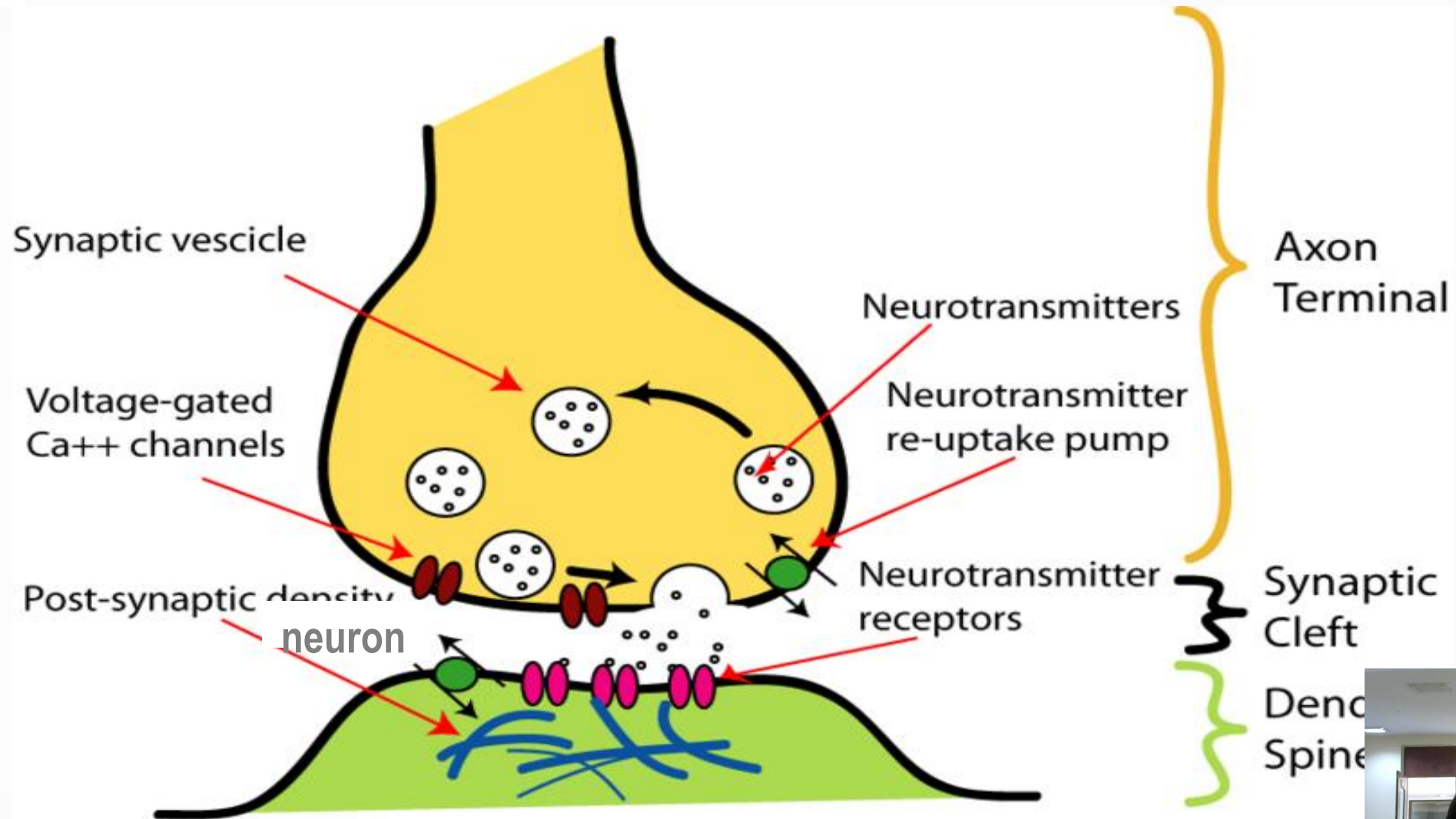
- axo-dendritic
- axo-somatic
- axo-axonal



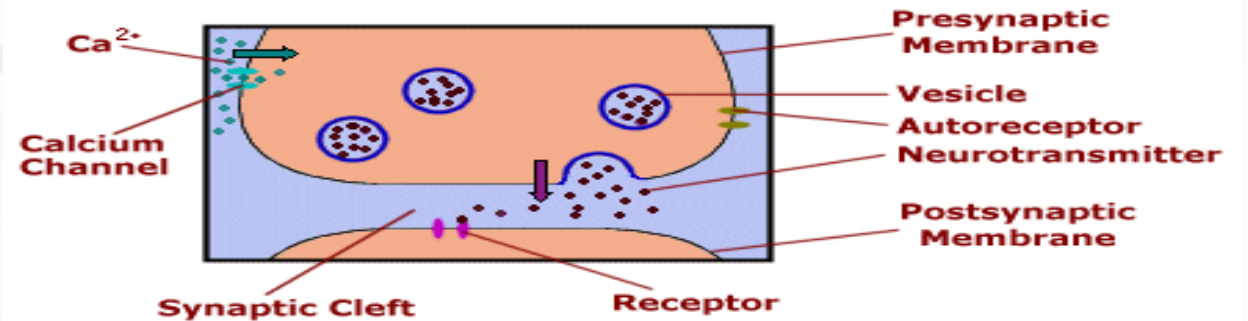
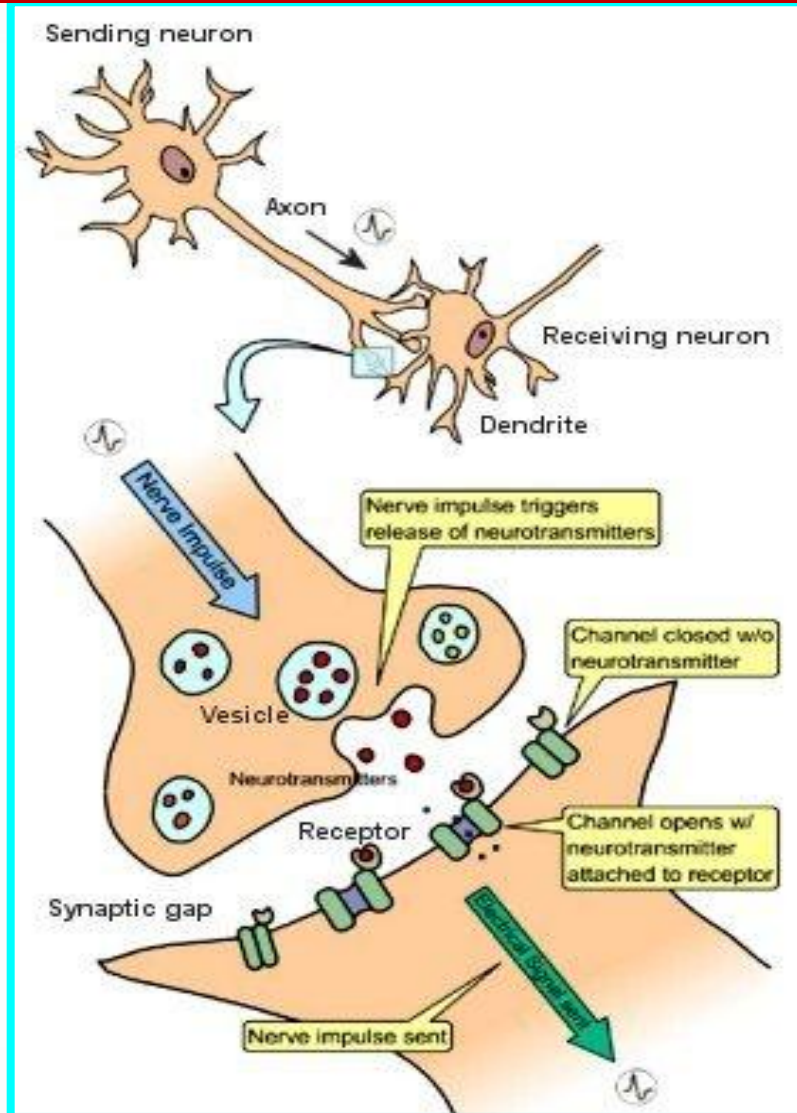
Synaptic transmission



Synaptic transmission

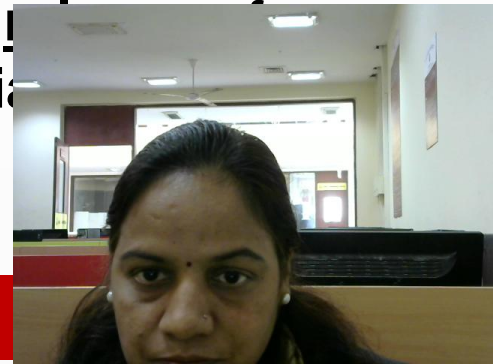


Synaptic transmission



Action potential comes via axon to the terminal at pre-synaptic membrane

1. **depolarization opens voltage gated Ca channels - Ca⁺⁺ diffuse into neuron**
2. **Ca⁺⁺ inside - vesicles towards the membrane (proteins stenine and neurine) - exocytosis – neurotransmitter (mediates) synaptic cleft**

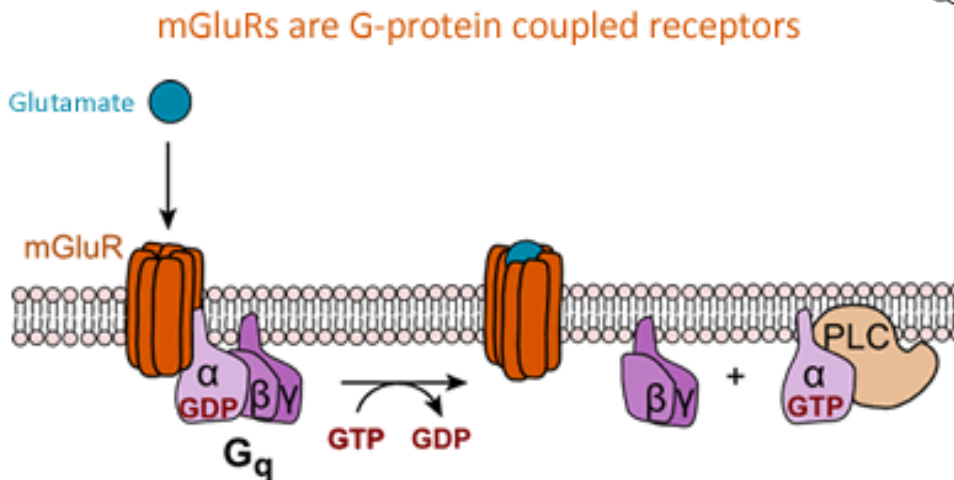
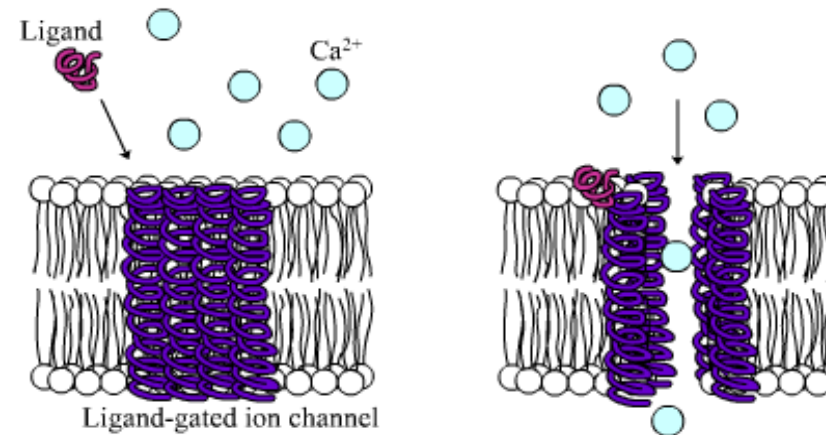


Synaptic transmission

4. mediator molecules activates receptors on subsynaptic part of postsynaptic membrane

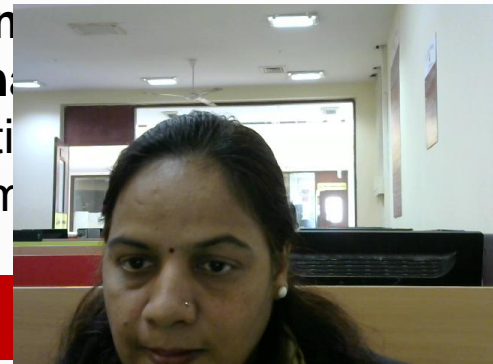
IONOTROPIC receptors

– ligand-gated channels producing EPSP or IPSP at post-synaptic cell

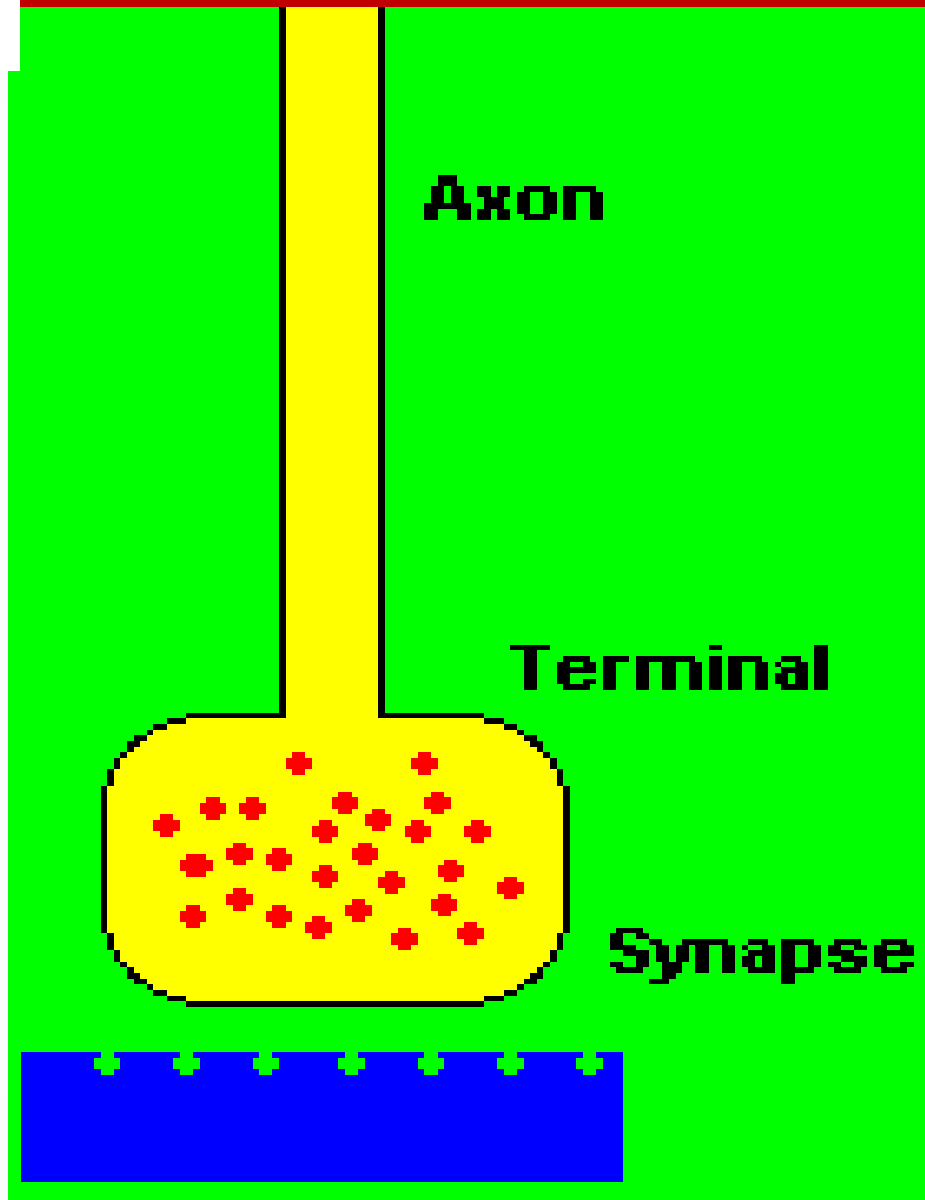


METABOTROPIC receptors

– mediator at extracellular domain activates intracellular G-protein leading to the intracellular signal (gene expression, chemical reactions, channels opening / closing – membrane permeability changes)



summary

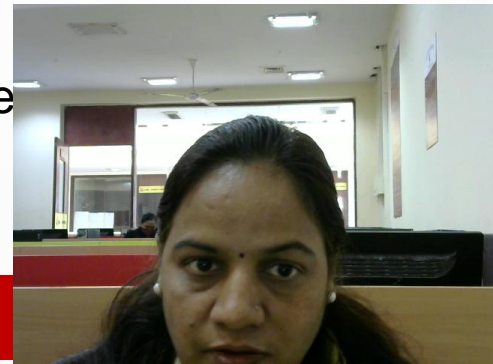


- action potential
- voltage gated Ca channels
- Ca^{++} influx
- vesicles exocytosis
- neurotransmitter (mediator) release
- its diffusion through the cleft
- interaction with receptors (e.g. ligand gated channels)

How does action stop?

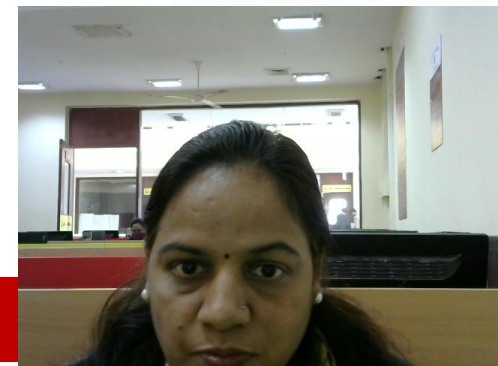
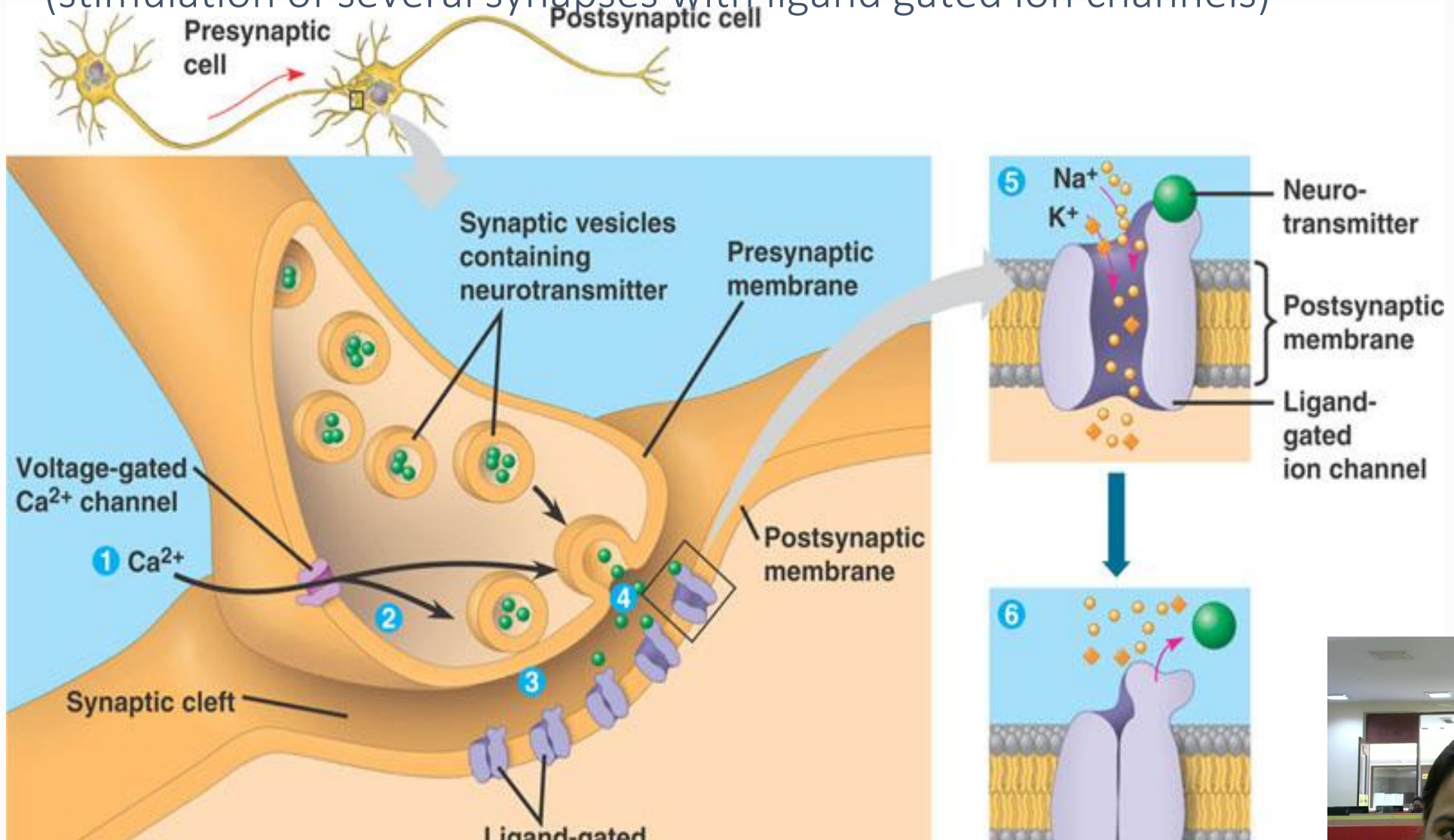
elimination of neurotransmitter

- reabsorbed by the presynaptic cell (re-packaged into vesicles)
- broken down metabolically
- diffused away



Summation of postsynaptic potentials

(stimulation of several synapses with ligand gated ion channels)



Why are chemical synapses called chemical?

What ion initiates synaptic transmission?

Where is neuromediator stored?

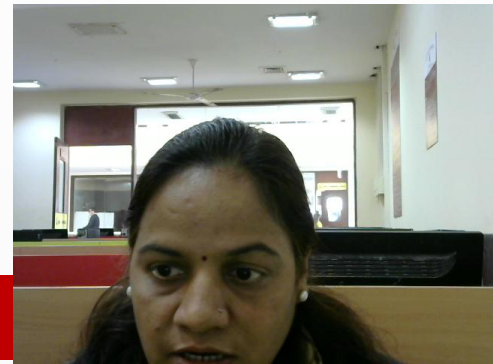
Where is it released?

Where does neurotransmitter act?

What is main difference between metabotropic receptor and ligand gated channel?

What is the difference between ligand gated and voltage gated channel?

Where are employed ligand and where voltage gated channels in the synaptic transmission?



REFERENCES

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3. Elias, Lorin J.; Saucier, Deborah M. (2006). *Neuropsychology: Clinical and Experimental Foundations*. Boston: [Pearson/Allyn & Bacon](#). [ISBN 978-0-20534361-4](https://www.pearson.com/us/higher-education/product/Pearson-Allyn-Bacon-Neuropsychology-Clinical-and-Experimental-Foundations-9780205343614/p,9780205343614). [LCCN 2005051341](#). [OCLC 61131869](#).
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