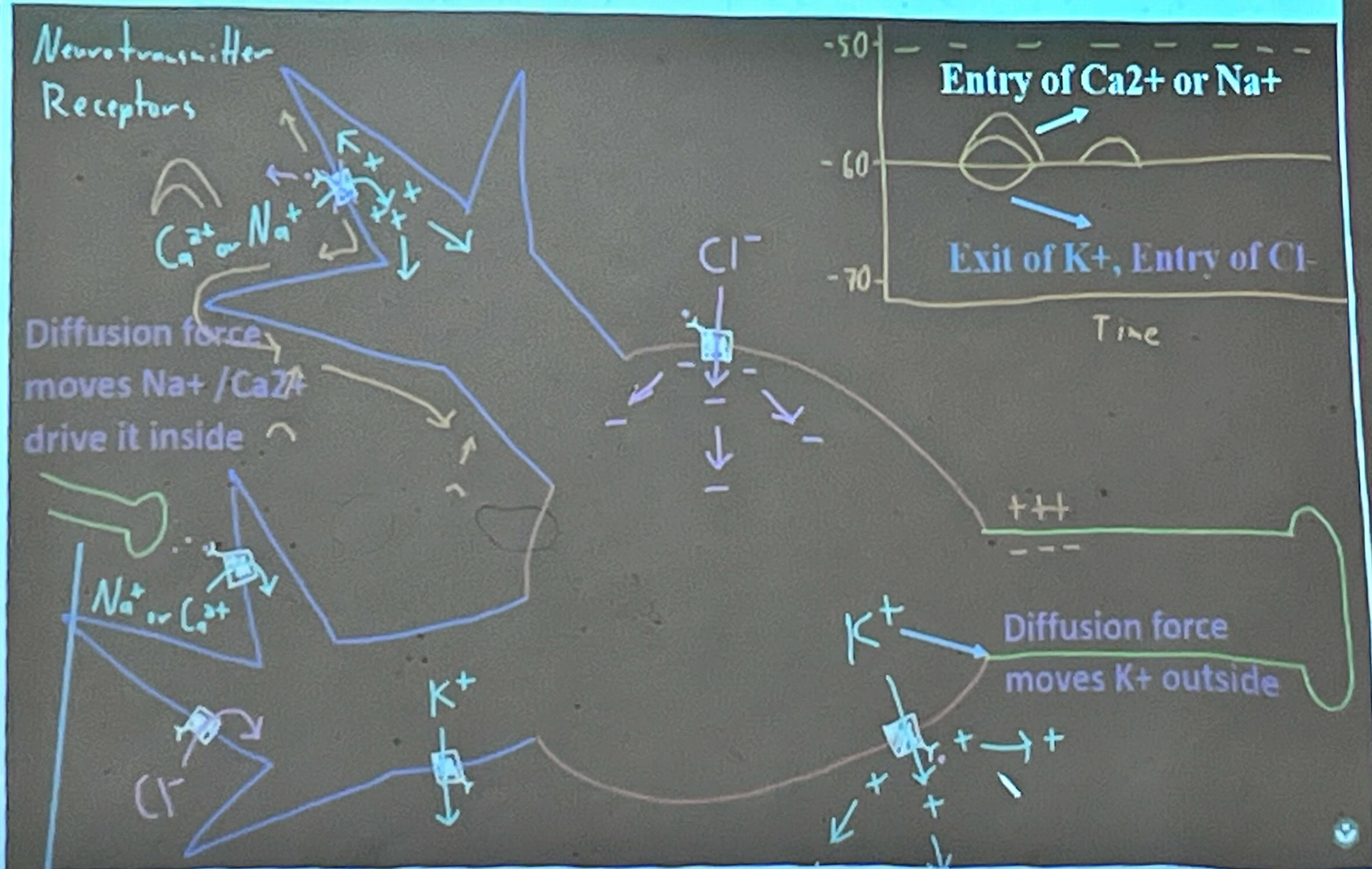


Ligand gated channel opens (when neurotransmitter binds to receptor)

Graded Potentials

- *Transient membrane potential* changes occur in resting potential of neurons and are called *Graded potentials.*

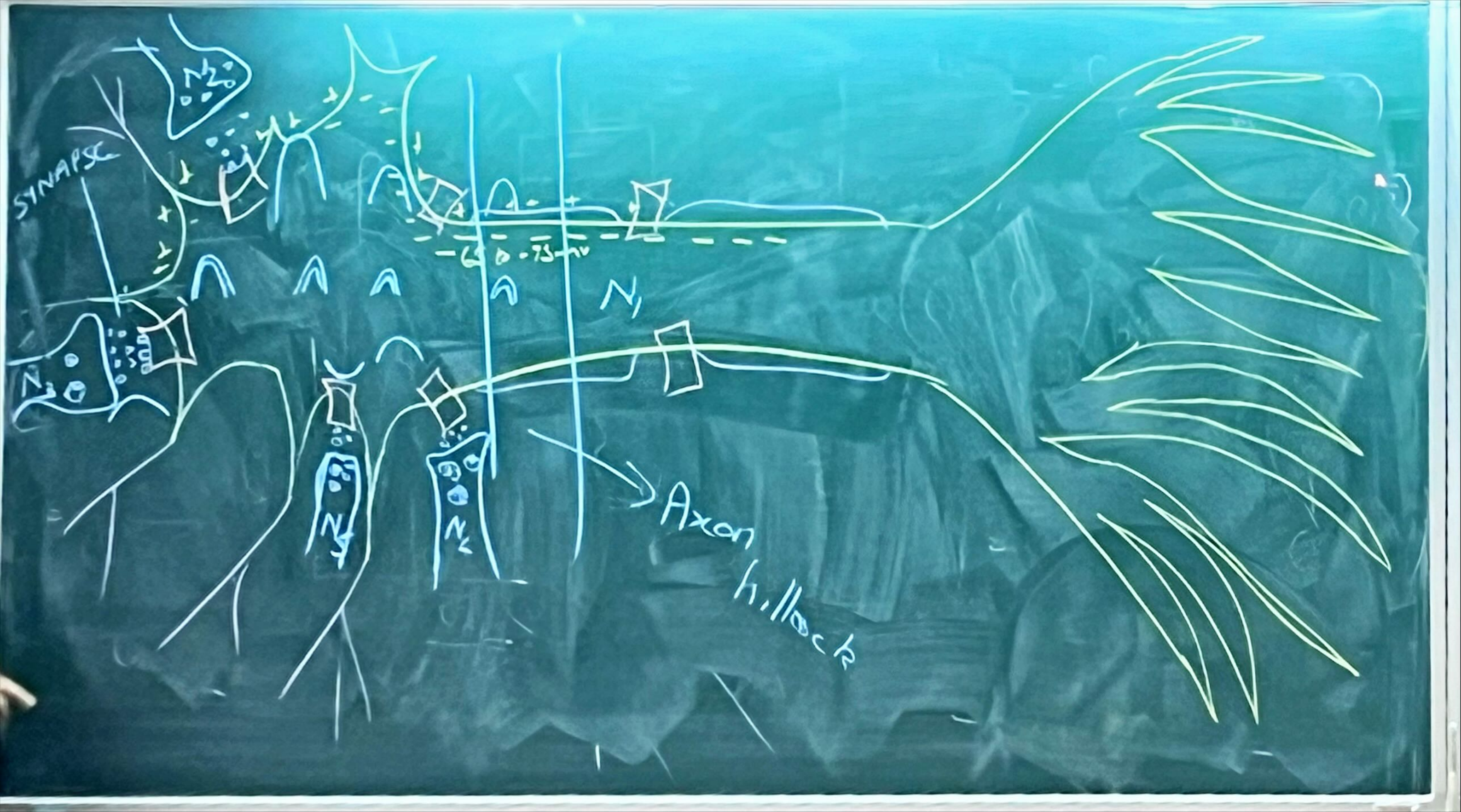
- They occur in the *dendrites* and *soma* of the neuron.

- Excitatory input *depolarizes* while inhibitory input *hyperpolarizes* membrane potential.

- Size and duration of graded potentials is determined by size/duration of inputs (Excitatory and inhibitory).

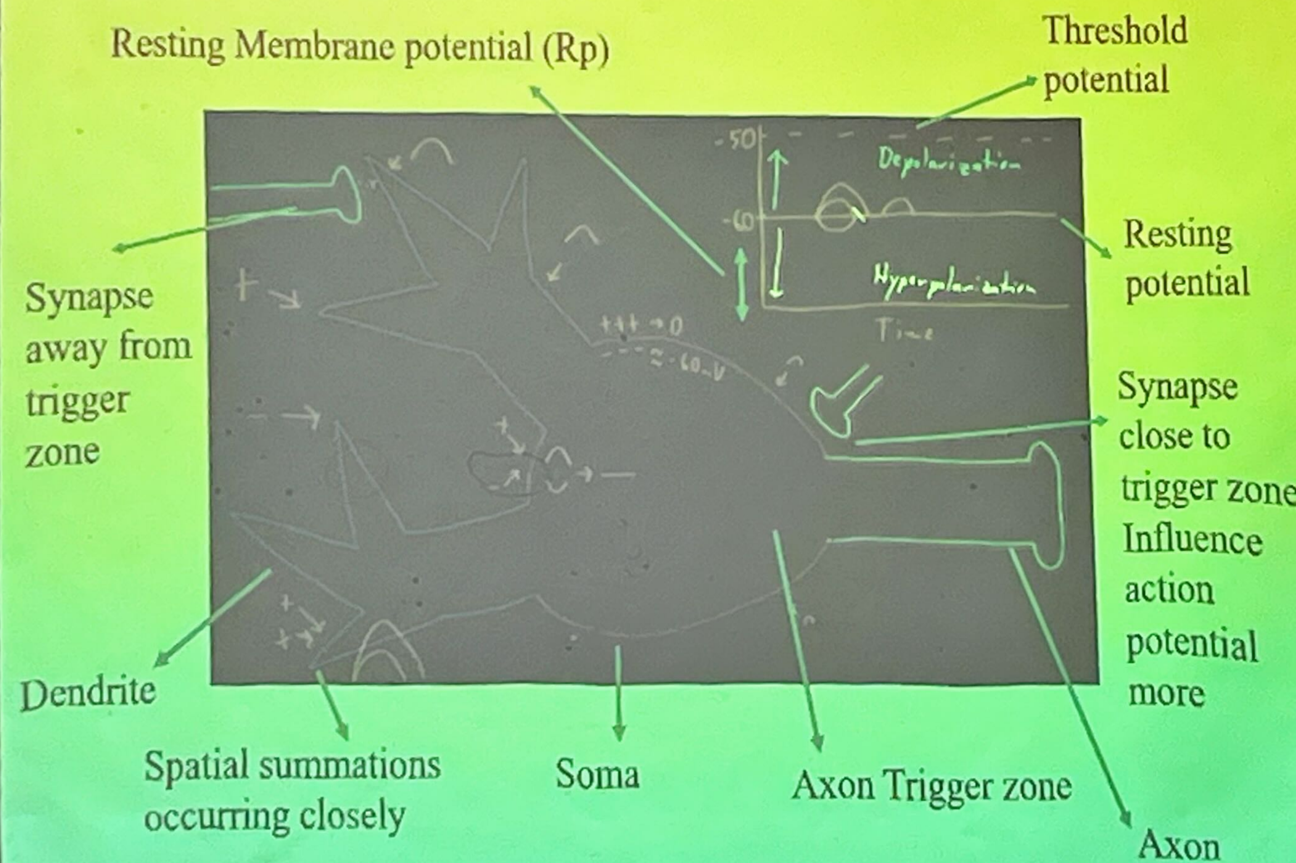
- Graded potentials decay with time and distance.

- Graded potentials do not pass into the *axons of the*



SYNAPSE
N_2
N_3
N_1
N_5
N_6
-65 to -75 mV
Axon hillock

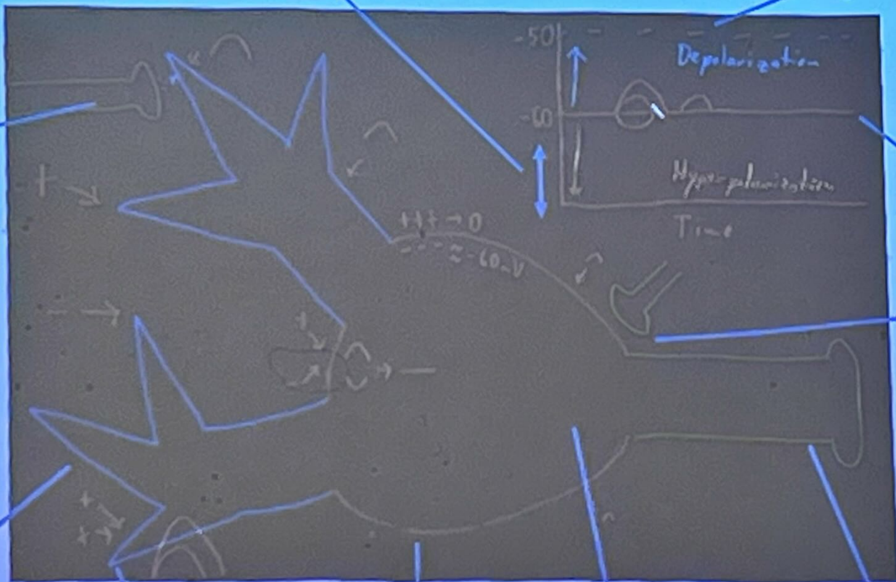
Graded Potentials (Quick Look)



Graded Potentials (Quick Look)

Resting Membrane potential (Rp)

Threshold potential



Synapse away from trigger zone

Resting potential

Synapse close to trigger zone Influence action potential more

Dendrite

Spatial summations occurring closely

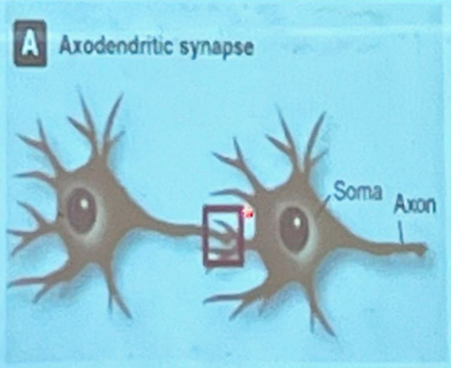
Soma

Axon Trigger zone

Axon

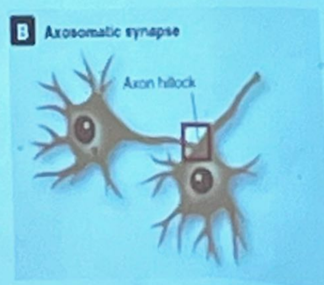
What is Graded Potentials??

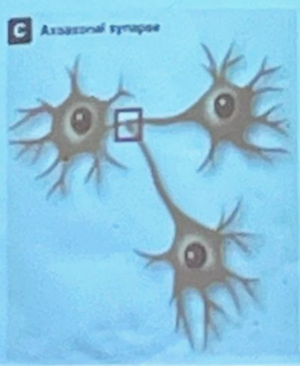
Types of Synapse



a. **Axodendritic synapses:** The most common synaptic contacts in the CNS are between an axon and a dendrite called **axodendritic synapses**. The dendritic tree of any given multipolar neuron will receive thousands of axodendritic synaptic inputs, which will cause this neuron to reach threshold (see below) and to generate an electrical signal, or **action potential**. The architecture of the dendritic tree is a key factor in calculating the convergence of electrical signals in time and in space (called **temporospatial summation**, see below).

b. **Axosomatic synapses:** An axon can also contact another neuron directly on the cell soma, which is called an **axosomatic synapse**. This type of synapse is much less common in the CNS and is a powerful signal much nearer to the axon hillock where a new action potential may originate.

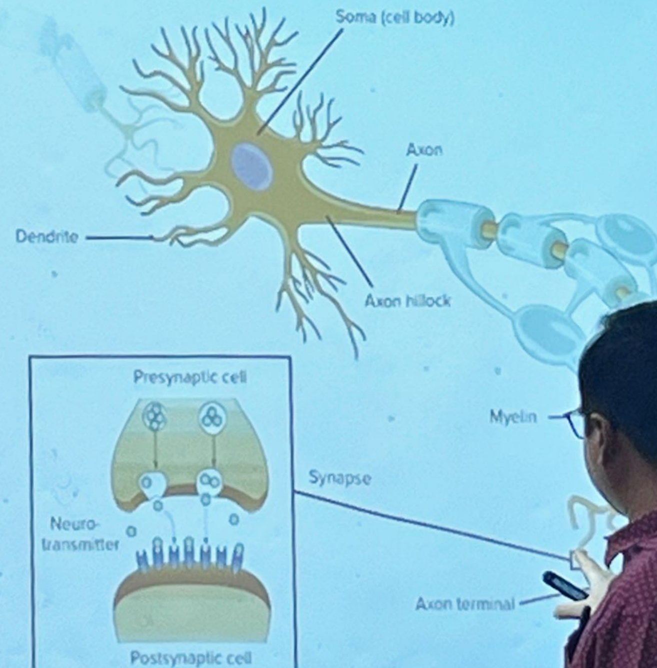




Axoaxonic synapses: When an axon contacts another axon, it is called an **axoaxonic synapse**. These synapses are often on or near the axon hillock where they can cause very powerful effects, potentially producing an action potential or inhibiting an action potential that would have otherwise been fired.

Neurotransmitters

- Chemicals known as neurotransmitters (glutamate, dopamine) are stored in membrane-bound vesicles at the axon terminal of neurons.
- Get released when Ca^{2+} enters the axon terminal and act by binding to receptors on the membrane of the postsynaptic cell.
- They are "Excitatory" firing a target neuron (Glutamate) "Inhibitory" making a target neuron less likely to fire (GABA).



Neurotransmitters/Synapse

Concept of
Neurotransmitters/Synapse ?

Resting Membrane Potential

Resting Membrane Potential is developed in each and every neuronal cell (occurring in say brain or muscle)

In each neuron (say 100 billion in brain) this entire process happens passively and no energy is consumed.

Hence when relaxing we consume very less energy.

At times neuronal membrane is permeable to multiple ions (say Na+ and Cl^-) these ions could contribute miniscule amounts to Resting potential as well.

Goldmann equation

$$V = 61 \log \frac{P_K[K^+]_o + P_{Na}[Na^+]_o + P_{Cl}[Cl^-]_o}{P_K[K^+]_i + P_{Na}[Na^+]_i + P_{Cl}[Cl^-]_i}$$

V=membrane potential in V

P=permeability for each ion

The Goldmann equation takes into account the permeability (P) for each ion as well as the concentration gradient of each ion. The sum of this determines the resting membrane potential.

Please explore more about it in Textbooks (Long weekend Homework)

The **permeability** of the membrane determines how easily an ion

NERNST Equation Expression derived by us