Physio CNS (lec2)

❖ Presynaptic Potentials:

The release of chemical transmitter from presynaptic fiber at a particular synapse can be inhibited or facilitated by the action of other neurons (عشان يطلع الناقل العصبي من الخلية العصبية الاولى لازم هي كمان تتعرض لاشارات عصبية من خلايا تانية هتثبط او هتنشط خروج الناقل العصبي)

N.B. action potential at the presynaptic neuron is when reversal of polarity is **propagated along the plasma membrane**

يعني لو ما انتقلش على طول الغشاء مش هنسميه action potential و مش هيوصل للخلية الي بعده

❖ Characters of Synaptic Transmission (خصائص التشابك العصبي):

1- One-way Transmission:

- Transmission at the synapse occurs in one direction only from presynaptic terminal to postsynaptic neuron (unidirectional)

في اتجاه واحد من الخلية الي قبل التشابك للخلية الي بعد التشابك

2- Synaptic Delay:

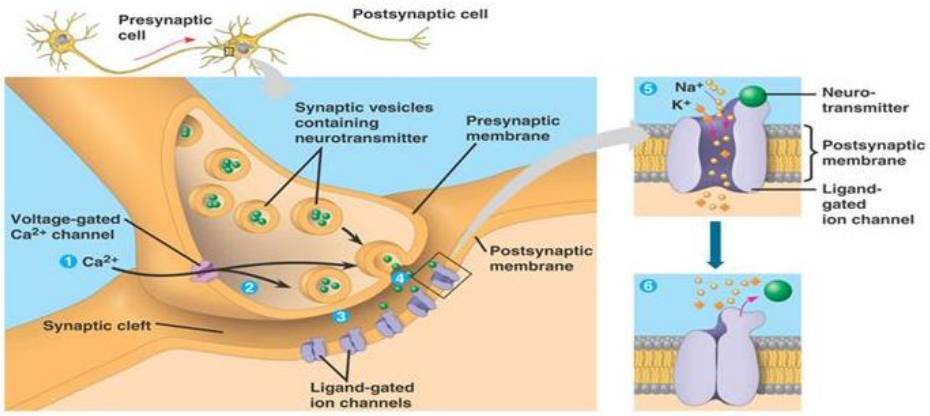
- This is the time delay between the arrival of action potential at the presynaptic knob and the development of postsynaptic potential الوقت اللازم لنقل الاشارة العصبية بين الخليتين
- This delay is about **0.5 msec**
- Synaptic delay is mainly due to the time needed for *release of chemical transmitter*, *diffusion of the transmitter to postsynaptic membrane*, *binding to receptors* and *opening or closure of ionic channels*

هي الوقت الي بتحتاجه الاعصاب عشان تطلع الناقل العصبي و يتحرك في الفاصل الي بين الخليتين و يرتبط بالمستقبلات و اخر حاجة فتح قنوات الايونات

N.B. Synaptic delay can be used to calculate the number of synapses in a reflex by dividing the central delay of the reflex by 0.5 msec

نقدر عن طريقها نحدد عدد الاعصاب الي بنعدي عليها اثناء نقل الاشارة العصبية باننا نقسم الوقت الي هتاخده عشان تنتقل على وقت ال synapse

This represents the time required for:



3- Fatigue:

- If the presynaptic fiber is **repeatedly stimulated** a lot, the magnitude of postsynaptic potential and the rate of discharge of postsynaptic neuron might decrease. This is known as fatigue of synaptic transmission.
- Fatigue is mainly due to **depletion of chemical transmitter vesicles** in ***presynaptic*** knob (بيحصل بسبب ان الناقل العصبي بيخلص في العصب الاول)

❖ Factors affecting synaptic transmission:

1- Changes of internal environment of the body:

a- pH of extracellular fluid (the most important factor):

acidosis *inhibits* synaptic transmission (hyperpolarization due to increase extracellular positive charge [H^+]) and may lead to *coma* e.g. *diabetic coma* (diabetes causes keto-acidosis). **Alkalosis *stimulates*** synaptic transmission (excitation due to decrease extracellular positive charge [OH^-]) E.g. hyperventilation can induce an *epileptic fit*. Alkalosis occurs in cases such as hyperventilation (التنفس الحاد) due to loss of CO_2

b- Hypoglycemia: (الجلوكوز هيقل) glucose is the **main fuel utilized by the brain**, so hypoglycemia leads to inhibition of synaptic transmission.

c- Hypoxia: synaptic transmission is inhibited by hypoxia.

Ischemia (نقص كمية الدم) of the brain for few seconds causes

unconsciousness whereas prolonged ischemia for few minutes causes brain damage.

d- Hypocalcaemia: (الكالسيوم هيقل) synaptic transmission is enhanced by hypocalcaemia due to Increase excitability of the postsynaptic membrane (increase postsynaptic Na^+ permeability)

2- Drugs:

a. **Caffeine**, **Theophylline** (in tea), **Theobromine** (منبهات) facilitate synaptic transmission by *depolarizing the postsynaptic membrane*.

b. Strychnine competes with inhibitory neurotransmitter (يتنافس مع المثبطات فبيقلل عدد المثبطات الي بتقوم بوظيفتها) at postsynaptic membrane. This leaves the action of excitatory transmitters unopposed (بيزود الاستثارة) leading to muscle *spasm and death*

c. Analgesics (مهدئات), Hypnotics and anesthetics (pain killers) act either by stabilizing membrane potential or by interference with synthesis and release of chemical transmitters. (بتأثر على تصنيع و خروج الناقل العصبي فبتقلل الاستثارة)

3- Diseases:

a. Tetanus: a disease caused by a special type of toxin-producing bacteria. Tetanus toxin inhibits the release of the inhibitory (سالب السالب موجب) transmitter GABA leading to *spastic paralysis* (paralysis due to continuous contraction) *and death* (بيزود الاستثارة لحد التشنج و الموت)

b. Botulism: a special type of bacteria produces a toxin known as botulism toxin. This toxin prevents the release of acetylcholine (بيقلل) at neuromuscular junction leading to *flaccid paralysis* (paralysis due to relaxation)

c. Myasthenia gravis: auto-antibodies (autoimmunity disease الجسم بيهاجم نفسه) against acetyl choline receptors at neuromuscular junction leading to *gradual muscle weakness and finally paralysis* (بيسبب ضعف العضلات ثم الشلل)