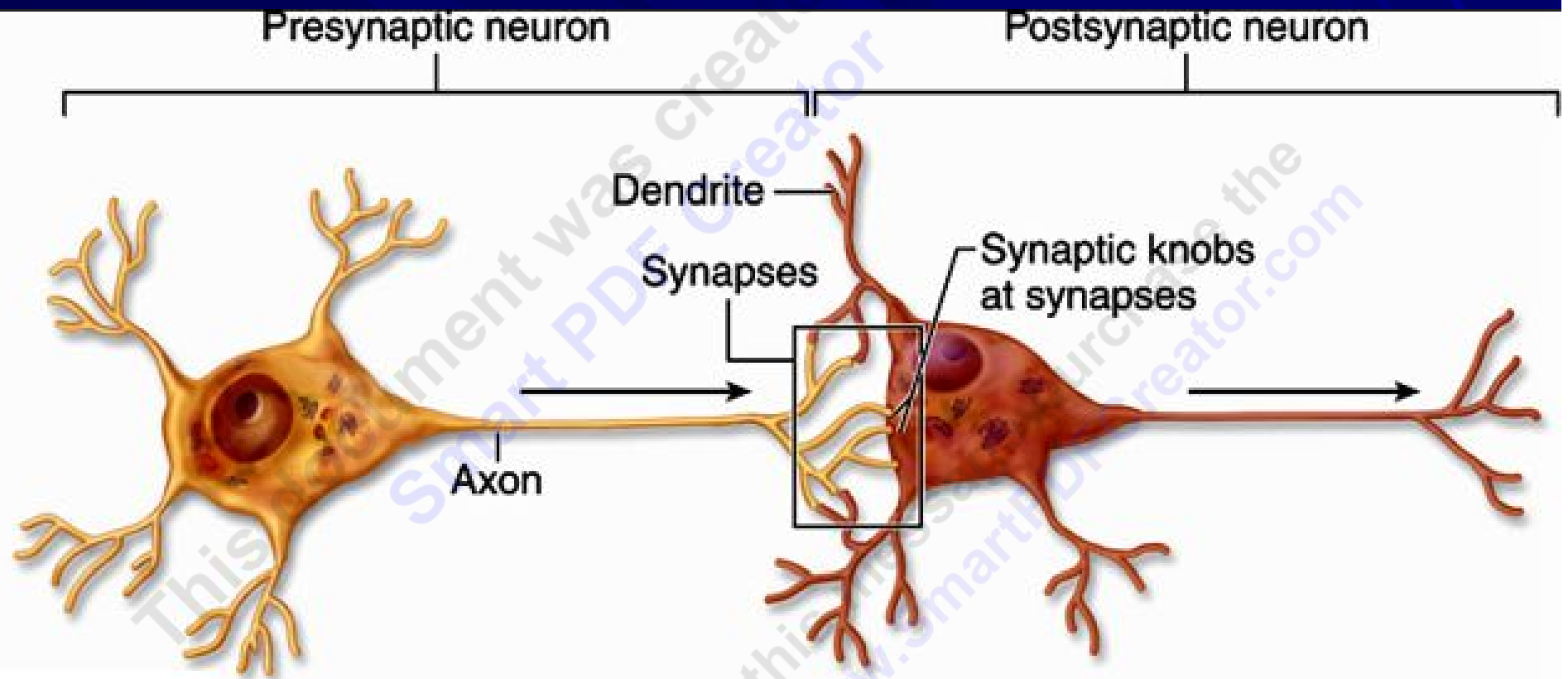


# Physiology Synapses and Receptors

Dr Taha Sadig Ahmed

Physiology Department , College of Medicine ,  
King Saud University , Riyadh

# What are synapses ?



■ Where are they located ?

# Classification of Synapses According to Location

✓ They could be :

- (1) Axo-dendritic
- (2) Axo-axonal ( axo-axonic )
- (3) Axo-somatic ,
- & less commonly →
- (4) Dendro-somatic
- (5) Somato-somatic

- What are the parts of a synapse ?
- What does each part contain ?

# What is a neurotransmitter ?

- A neurotransmitter is a chemical substances that is released by a neuron ( called presynaptic cell ) , crosses the synaptic cleft , and binds to a receptor located on the membrane ( postsynaptic membrane ) of another cell .

# What are the types of transmitters ?

- Excitatory neurotransmitter :  
a transmitter that produces excitatory postsynaptic potential ( EPSP) on the postsynaptic neuron .
- Inhibitory neurotransmitter :  
a transmitter that produces inhibitory postsynaptic potential ( IPSP ) on the postsynaptic neuron .

# EPSP and IPSP

- What is the nature of these bioelectric responses ?
- In what ways do they differ from action potentials ?
- In what way do they affect the excitability of the postsynaptic membrane ?

# Give examples of excitatory transmitters ?

- (1) Acetylcholine : Opens which type of membrane channel ?  
Leading to what ? Why ?
- (2) Glutamate : Opens which type of membrane channel ?



# Long – Term Potentiation (LTP)

- Define LTP ?
- What is the main neurotransmitter involved in LTP ?
- Give example of one of its physiological functions ?

# Give examples of inhibitory neurotransmitters ?

- (1) GABA : Opens which type of membrane channel ? Leading to what ? Why ? Example of physiological function ?
- (2) Enkephalin : Opens which type of membrane channel ? Leading to what ? Why ? Example of physiological function ?

# Give examples of inhibitory neurotransmitters ?

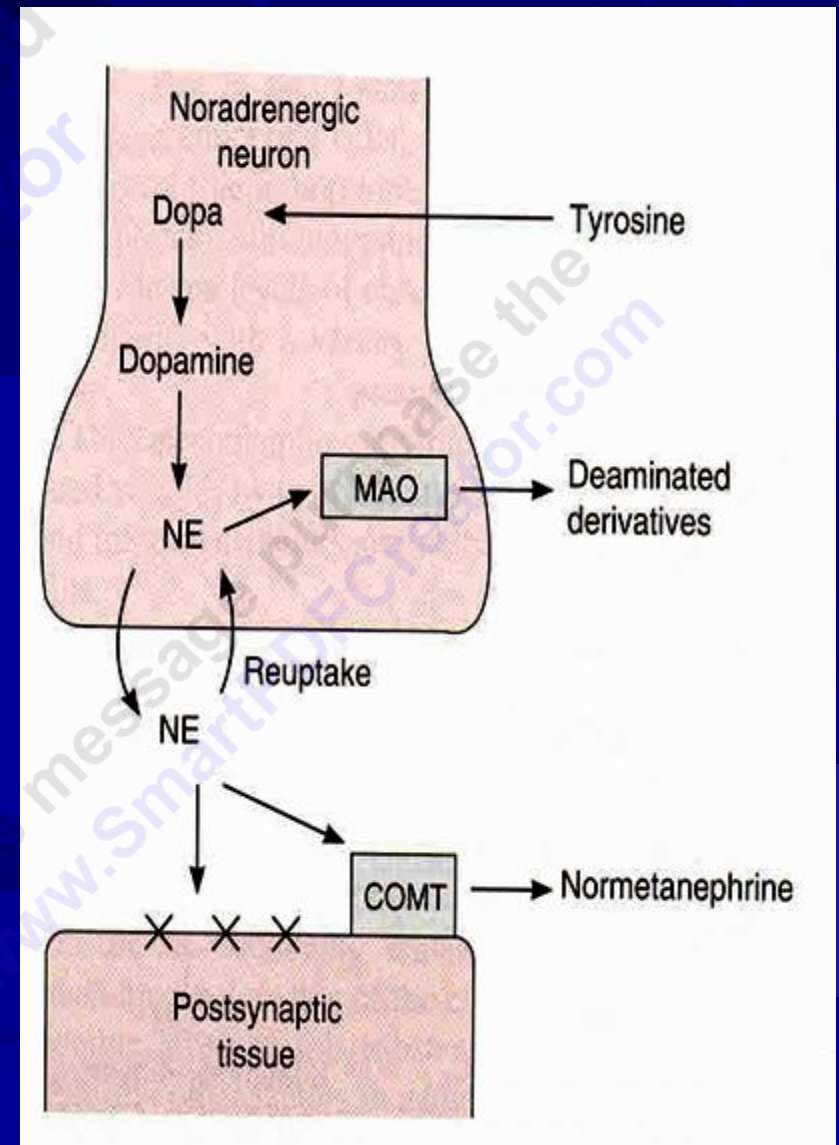
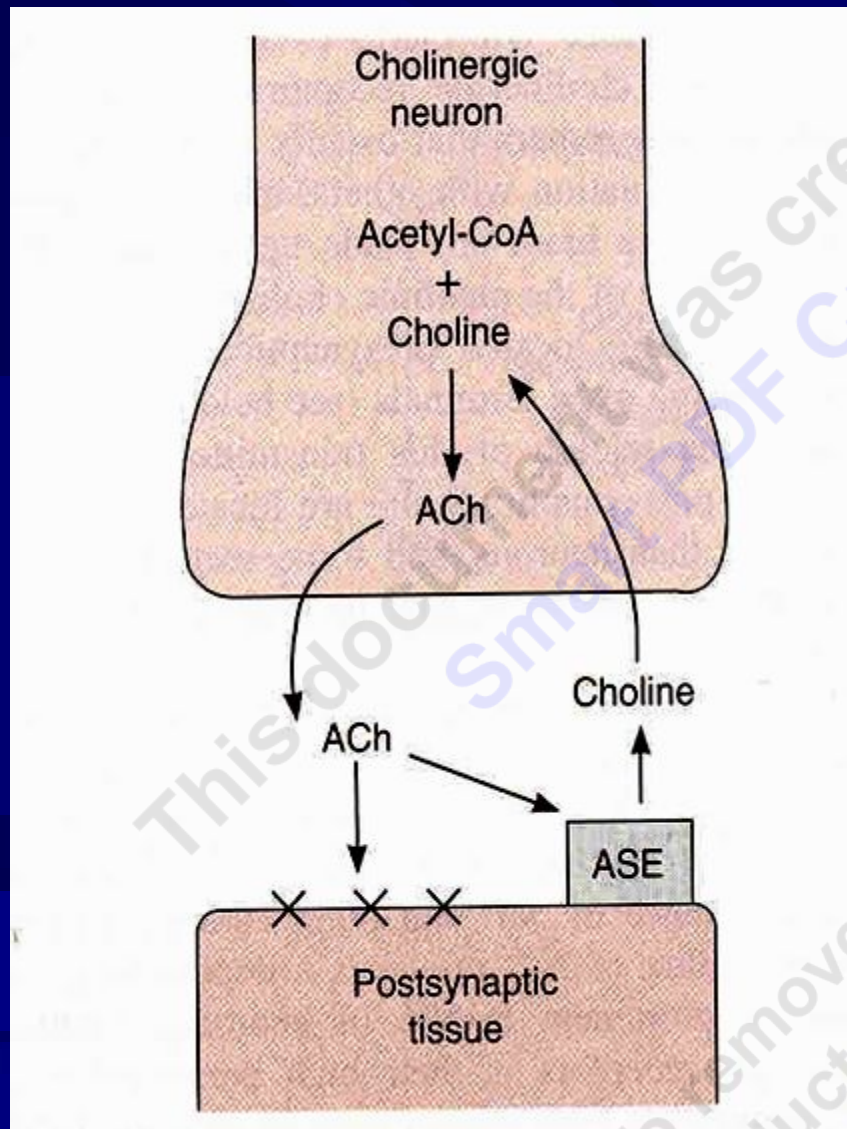
- (1) GABA : Opens which type of membrane channel ? Leading to what ? Why ?
- (2) Enkephalin : Opens which type of membrane channel ? Leading to what ? Why ?

# Formation of a Transmitter

- Q : In what location of the neuron is the neurotransmitter synthesized ?
- Q : In what location of the neuron is the transmitter vesicle synthesized ?
- How are these processes functionally coupled to produce successful synaptic transmission ?

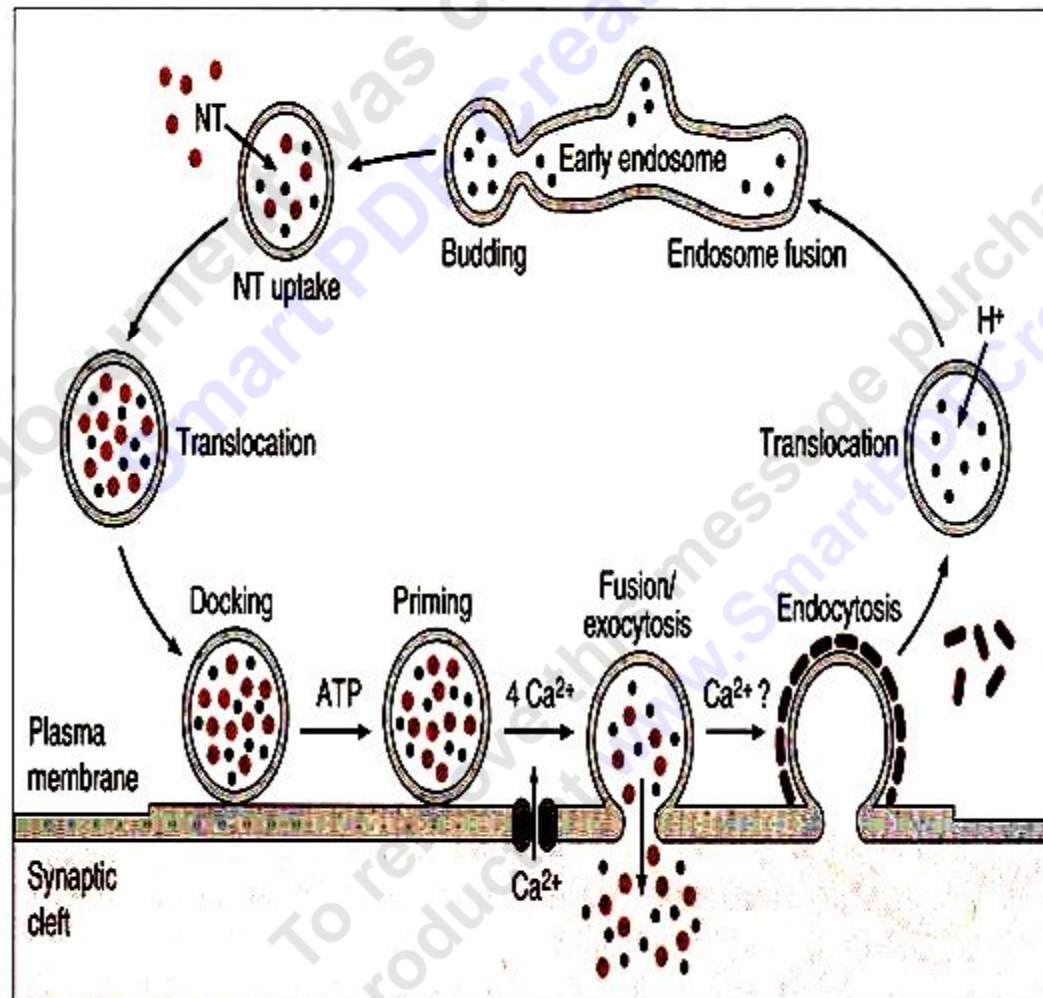
# Final Fate of Transmitter

- Q : What happens to the transmitter after it has combined with its postsynaptic receptors and produced its physiological effect ?
- In the synaptic cleft there are enzymes that will then destroy the receptor .
- Examples :
- In case of Acetylcholine →  
Acetylcholinesterase (ACh-esterase) ;
- In case of Noradrenaline → Catechol-O-Methyl  
Transferase ( COMT )





# Vesicle Recycling



# Examples of Factors that Affect Neurotransmission

- What is the effect of :
  - Alkalosis ?
  - Hypoxia ?
  - Acidosis ?



# Some Properties of Synapses & Synaptic Transmission

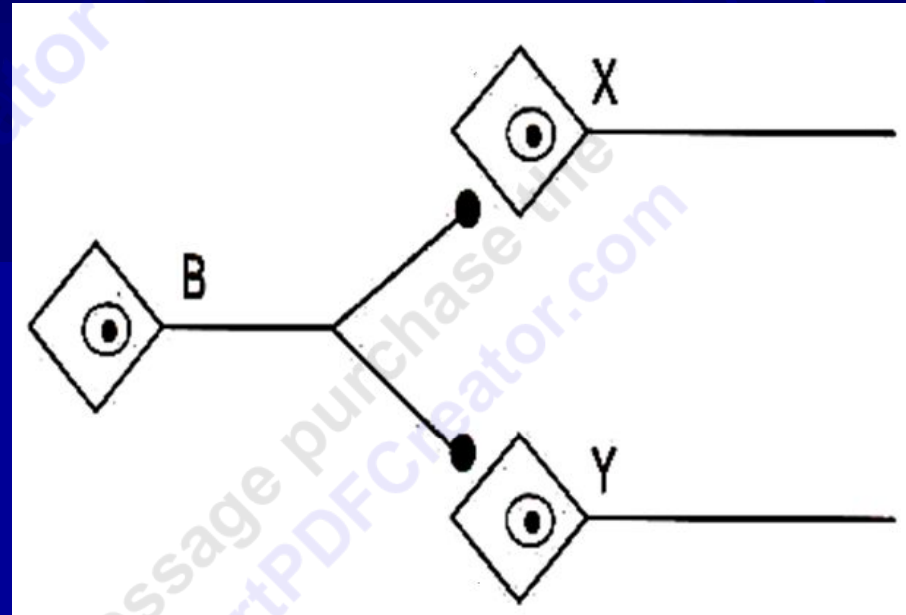
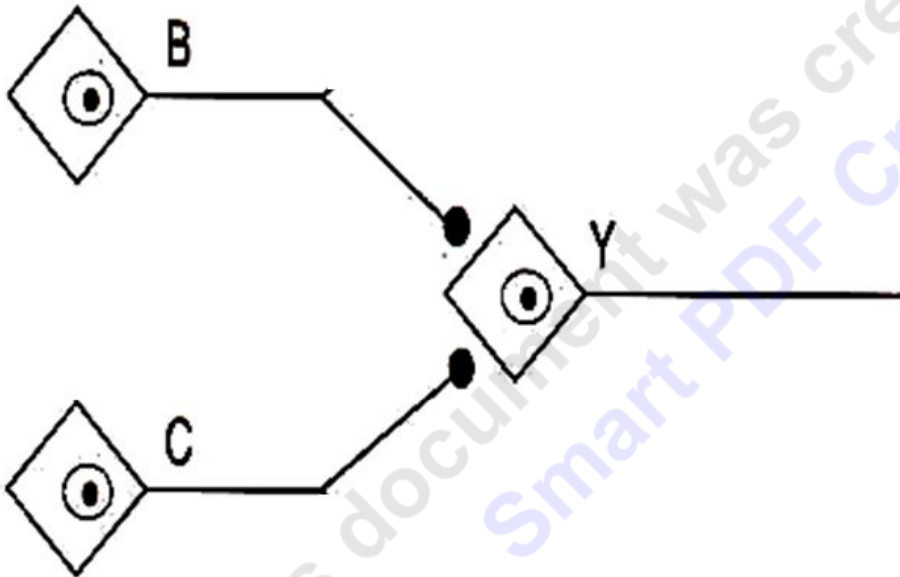
# 1/ ONE WAY CONDUCTION

- Why ?

# 2/ SYNAPTIC DELAY

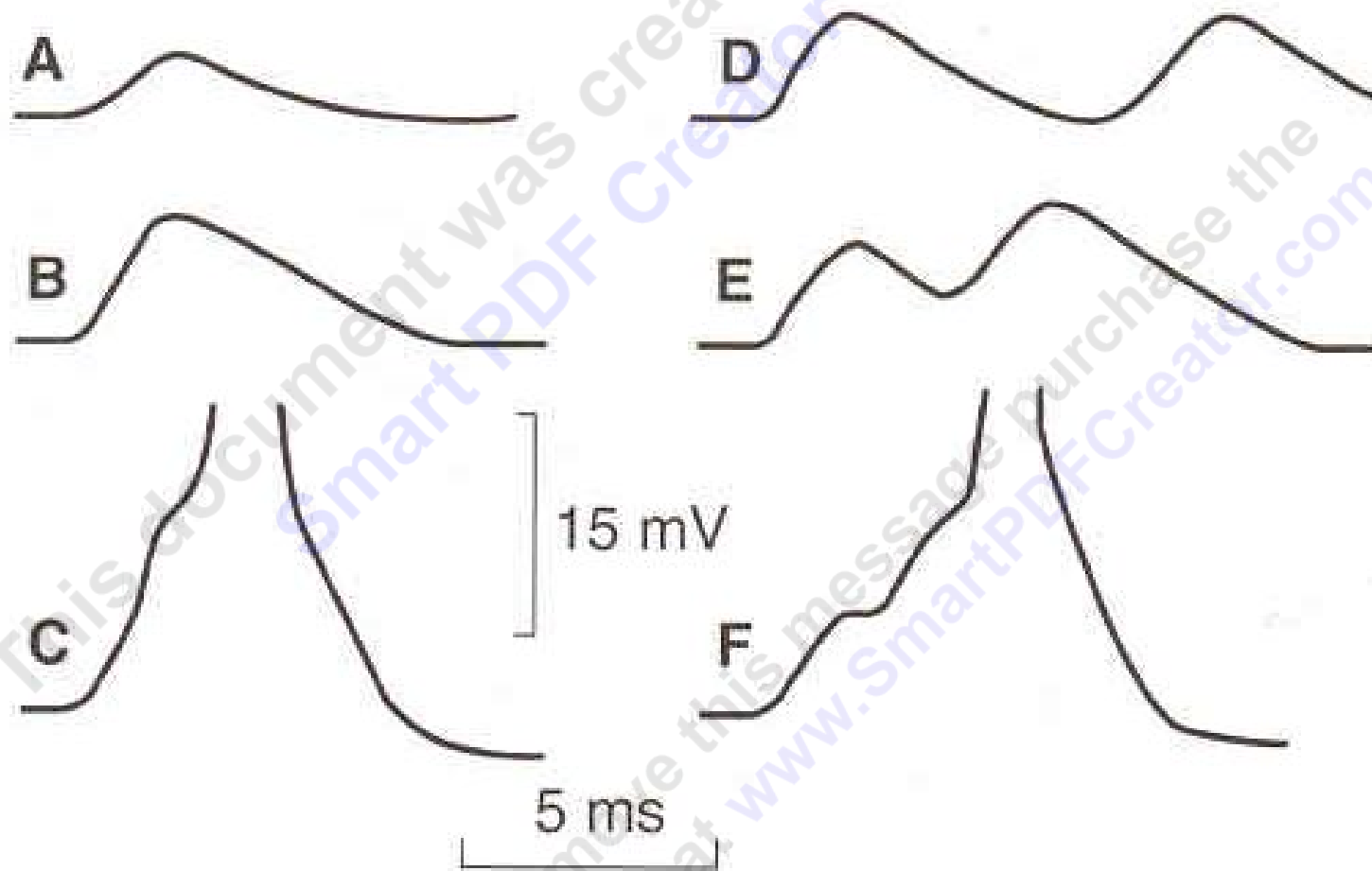
- Why ?
- Duration of delay in a one synapse ?
- What do we mean by total synaptic delay ?
- How can we , from the value of total synaptic delay , determine the number of synapses between two neurons ?

### 3/ Convergence and Divergence



- What is the physiological role of convergence ?
- What is the physiological role of divergence ?

## 4/ Summation : Spatial and Temporal



# 5/ Inhibition (1)

- Presynaptic inhibition ?

*Where ?*

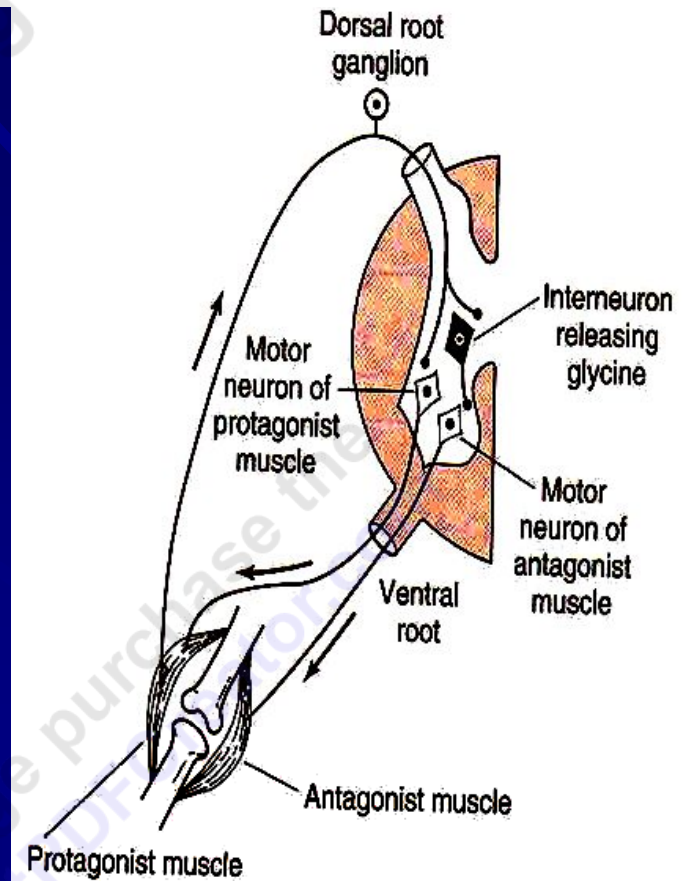
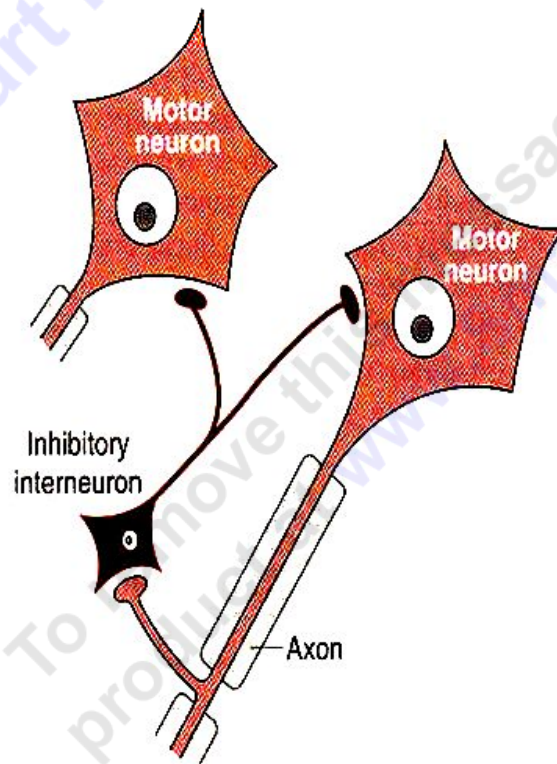
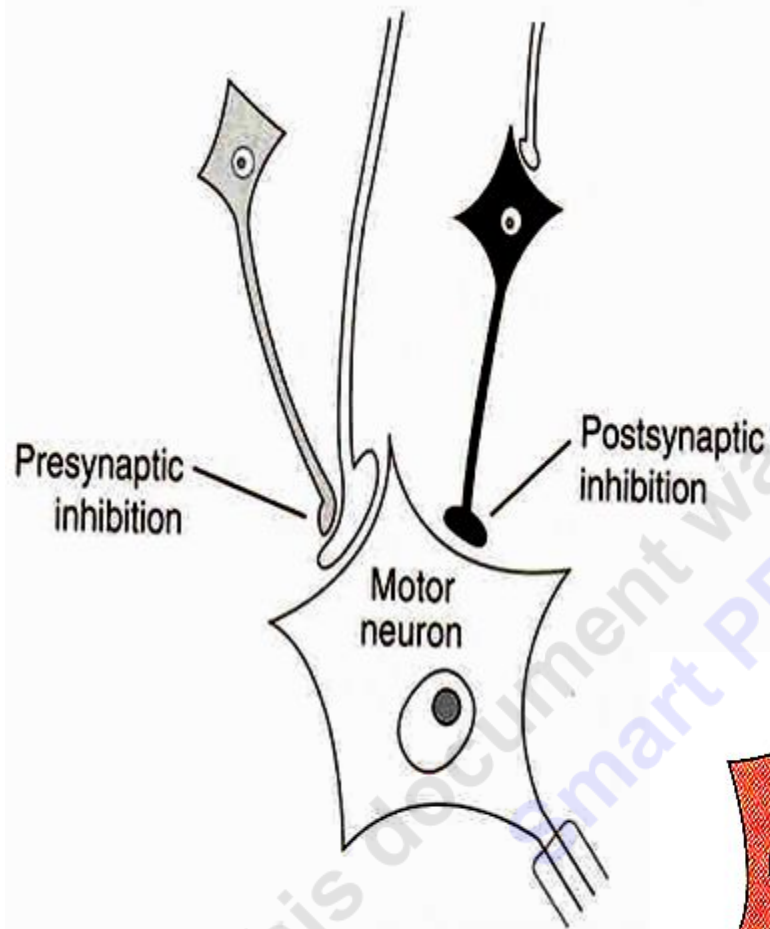
*Mediator ?*

- Postsynaptic inhibition ?

- Reciprocal inhibition ?

- Inhibitory interneuron ?

*Example ? Renshaw cell ?*



# Inhibition (3)

- Define :

*Feed-back inhibition ?*

*Feed-forward inhibition ?*

*Lateral inhibition ?*

- Explain physiological significance of each ?

*Thanks !*