

Nervous systems

Keywords (reading p. 1022-1038)

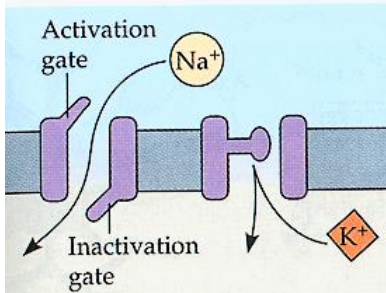
- Integration of synaptic signals
 - Cyclic GMP (cGMP)
 - Phosphodiesterase
- Neurotransmitters
- Acetyl choline
- Norepinephrine
- Serotonin
- Dopamine
- Amino acid neurotransmitters
- Endorphins
- Nitric oxide (NO)
- Guanylate cyclase

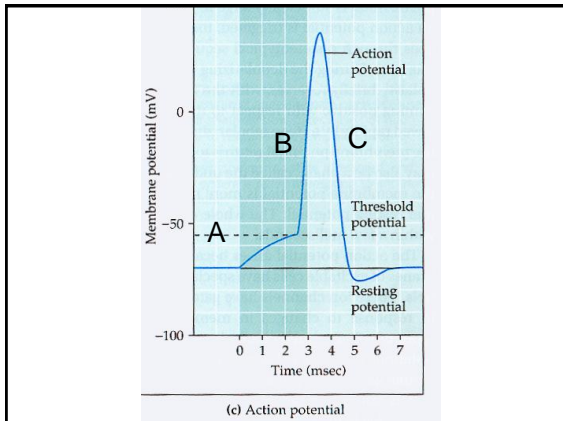
Sample test question:

- True or False: The concentrations shown in this diagram are correct

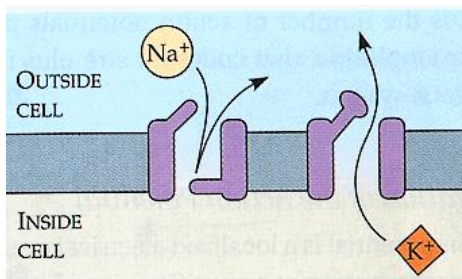
[Na ⁺]	[K ⁺]	[Cl ⁻]	Outside cell
15 mM	150 mM	10 mM	
-	-	-	
+			Inside cell
[Na ⁺]	[K ⁺]	[Cl ⁻]	
150 mM	5 mM	120 mM	

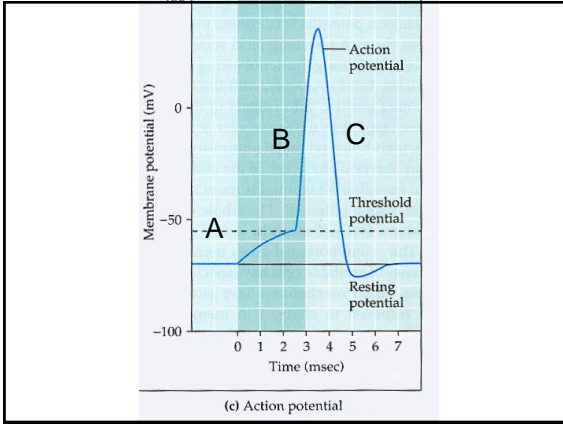
During which part of the action potential does this occur (Na^+ entering axon)?

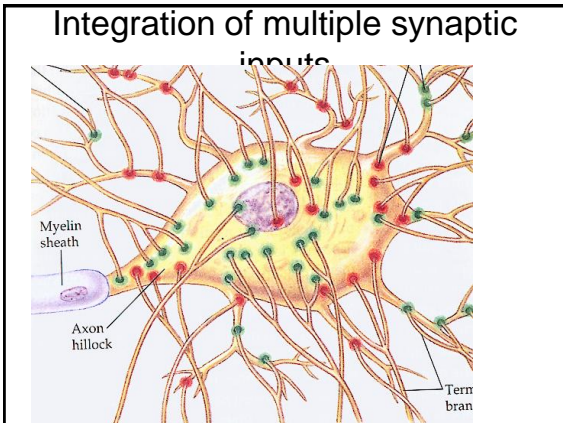


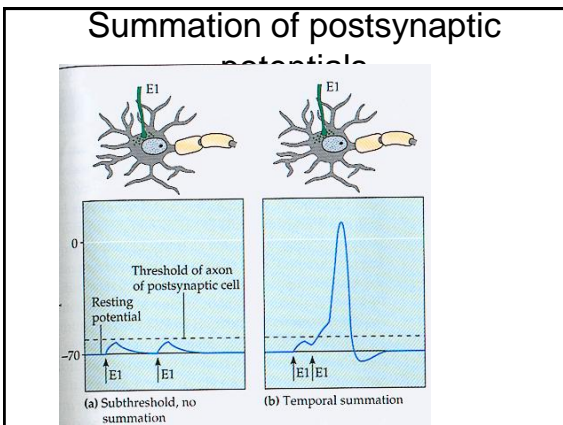


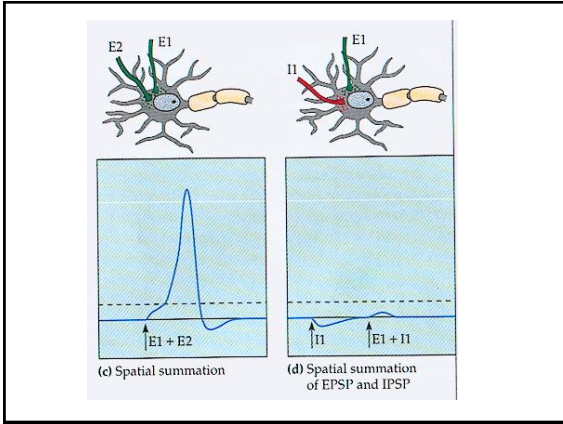
During which part of the action potential does this occur (K^+ leaving axon)?

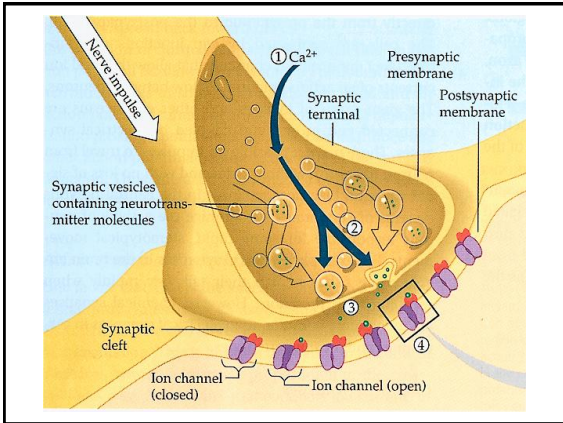






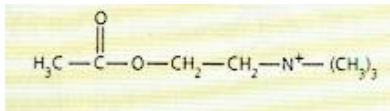






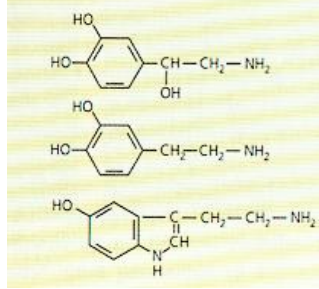
Neurotransmitters

- Acetylcholine (ACh) - excitatory to vertebrate skeletal muscle; other effects at other sites



Biogenic amine neurotransmitters

- Norepinephrine
- Dopamine
- Serotonin
- Usually function within the central nervous system



Dopamine

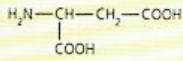
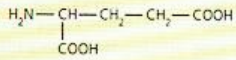
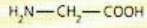
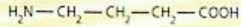
- High levels are linked to schizophrenia

Serotonin

- Low levels linked to clinical depression
- Prozac: Selective serotonin reuptake inhibitor

Amino acid neurotransmitters

- GABA (gamma amino butyric acid)
- Glycine
- Glutamate
- Aspartate
- Used in the central nervous system

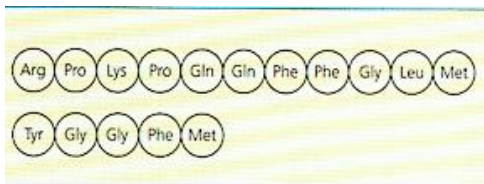


GABA

- Inhibitory synapses in brain
- Produces hyperpolarization by opening chloride channels

Neuropeptide neurotransmitters

- Substance P
- endorphins



Substance P

- Excitatory signal gives rise to perception of pain

Endorphins

- Decrease perception of pain
- Receptors for endorphins also recognize opiates (e.g., morphine and heroin)
- Endorphins are also hormones produced by the anterior pituitary

Norepinephrine/serotonin and depression

- Catecholamine hypothesis - depression represented a decreased availability of norepinephrine and/or serotonin
- Treatments are electroshock therapy and drugs to increase norepinephrine and/or serotonin availability

Drug treatments

- Selective serotonin reuptake inhibitors (SSRI)
 - Fluoxetine HCl – Prozac
 - Trazodone – Desyrel
 - Sertraline HCl – Zoloft
 - Paroxetine HCl – Paxil

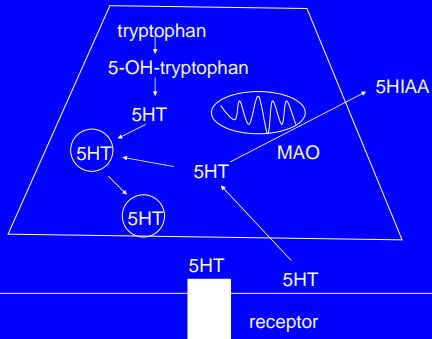
Drug treatments

- Tricyclic antidepressants
 - Block high affinity serotonin and norepinephrine reuptake systems
 - Increase sensitivity of serotonin receptors
 - Example: Amitriptyline - Elavil

Drug treatments

- Monoamine oxidase (MAO) inhibitors
 - Example: Phenelzine-Nardil

Serotonergic synapse



A newly discovered class of neurotransmitters (gases)

- Late 80's nitric oxide (NO) and carbon monoxide (CO)
- NO causes smooth muscle cells to relax resulting in dilation of blood vessels

NO has rapid effects

- Produced from the amino acid arginine
- NO can readily diffuse through tissues
- Half life of NO is only 5-10 seconds
 - Turned into nitrates and nitrites
- Effects of NO occur within seconds, and also end within seconds
