

BIOL 424
Neuron Communication 2

I. Neurotransmitters

A. Criteria

1. must mimic presynaptic effects if administered exogenously
2. must be released during activity of presynaptic neuron
3. action must be blocked by same agents that block natural transmission

B. Activity

1. fast-acting (direct) -
2. slow (indirect) -

C. Classification

1. small molecules
 - a.
 - b.
 - c.
2. neuropeptides
 - from hypothalamus, pituitary, and other organs
 - are often neurosecretory hormones

 - also endorphins and enkephalins
3. most are highly conserved
4. fast-direct transmitters
 - a. ACh
 - cholinergic neurons

 - curare is antagonist
 - AChE ---> acetate and choline
blocked by some toxins
 - b. glutamate
 - excitatory in vertebrate CNS
 - c. GABA-A (γ -Aminobutyric acid)

II. Biogenic amines/Monoamines

A. Serotonin -

B. Catecholamines -

- adrenergic neurons

1. epinephrine/adrenaline

2. norepinephrine/noradrenaline

- many psychoactive drugs mimic NE

cocaine-

3. dopamine (neurotransmitter)

C. Release and Uptake

1. similar release and effects to ACh

2. rapid inhibition following release

a. reuptake to presynaptic neuron

b. monoamine oxidase in presynaptic neuron

c. catechol-O-methyltransferase in postsynaptic neuron

III. Postsynaptic Activation

A. Fast Transmission channels

1. ACh nicotinic

a. stimulates skeletal muscle cells

b. ion channel is in receptor

c. ligand-binding BRIEFLY opens channel to Na^+ --> depolarization

2. GABA-A

a. receptors share homology with ACh receptors

b. most prevalent in brain

c. hyperpolarization

3. glycine

a. hyperpolarization

b. opens Cl^- channels

B. Slow channels

1. muscarinic

- a. ion channels on separate membrane proteins
 - b. ligand-binding activates G-protein complex
 - c. activation of G-protein complex coupled to activation of ion channel
2. cAMP levels can be increased or decreased depending on receptor subtype

V. Neuronal Integration

A. Motor neurons (α)

1. thousands of excitatory and inhibitory terminals on dendrites and soma
2. control frequency of firing of motor neuron
3. these terminals are weak
 - multiple stimuli to get AP

B. Spatial summation

1. inputs from several synapses summed to simultaneously change V_m
2. often a battle between EPSPs and IPSPs

C. Temporal summation

1. second potential follows close after first
2. piggyback
3. amplifies potential
4. spatial and temporal often together