

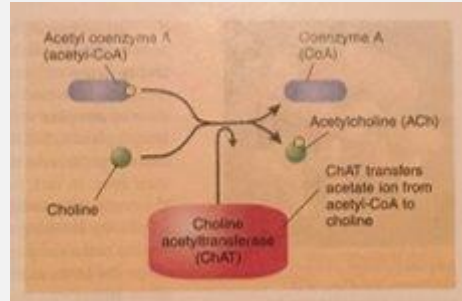
LECTURE 6: NEUROTRANSMITTERS II (DRUG ABUSE)

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Notes by: Marissa

ACETYLCHOLINE

- **Synthesis:**

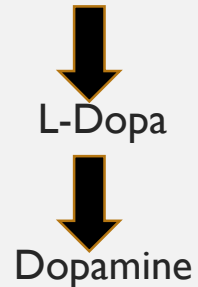


- **Found where?** Pons (REM sleep), Basal Forebrain (learning, long-term memory), Medial septum (brain rhythms, short-term memory in hippocampus), and Peripheral Nervous System (muscle contractions).
- **Receptors:** Mostly excitatory
 - Nicotinic- ionotropic (Na⁺) Stimulated by nicotine
 - Muscarinic- metabotropic (intracellular effects)a
- **Psychopharmacology:** 1st neurotransmitter discovered, ACh involved in muscle contractions in parasympathetic system, digestion, decrease HR, Botulinum (Botox) blocks ACh release (paralysis, death, wrinkles) produced by bacteria, poisonous, naturally occurring, and used medically. Curare blocks nicotinic receptors (paralysis, surgical procedures).
- Black widow spider's venom promotes ACh release causing convulsions and possibly death.

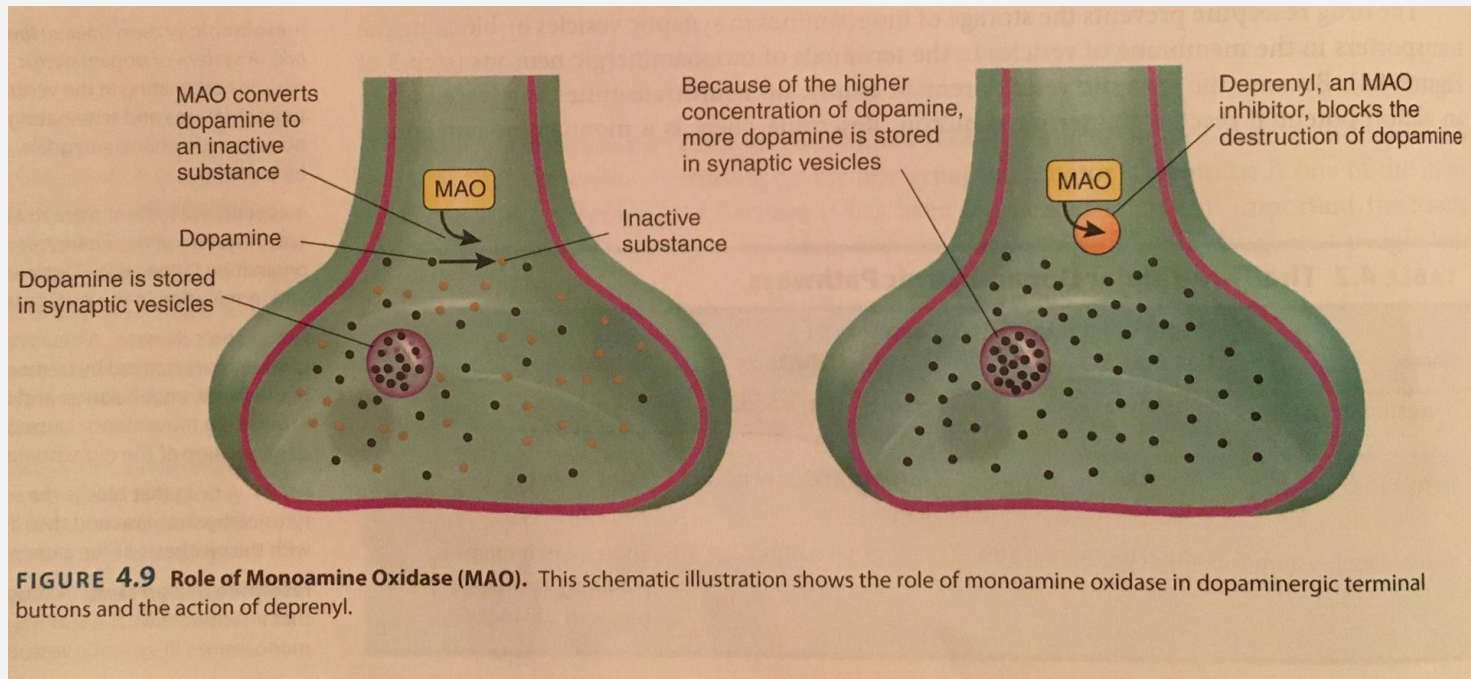
MONO AMINES: CATECHOLAMINES

DOPAMINE

- **Synthesis:** Tyrosine (high protein foods)

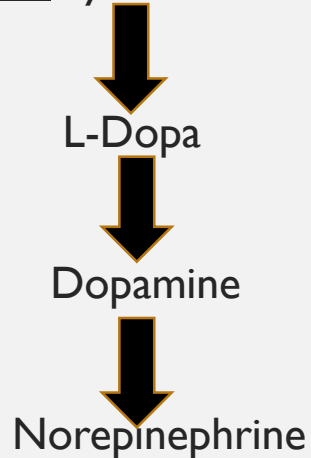


- **Found where?** Midbrain: Substantia Nigra, projects basal ganglia (movement), nigro-striatal <-> striatum: caudate and putamen, ventral tegmental area, projects limbic cortex (desire, reinforcement, emotions), projects prefrontal cortex (planning, problem solving), very localized production and diffuse projections.
- **Psychopharmacology:** "pleasure system" positive reinforcement and drug addiction, low levels=Parkinson's disease, high levels=Schizophrenia, amphetamines/cocaine=dopamine reuptake inhibitors, monoamine oxidase destroys "oxidizes" excessive monoamines, found naturally in blood from foods like cheese and chocolate, too much MAO linked with depression, MAO inactivates free-floating dopamine molecules, deprenyl destroys MAO's and increases dopamine.
- Dopamine does not cross blood-brain barrier however, L-Dopa does.



NOREPINEPHRINE (ADRENALINE)

- **Synthesis:** Tyrosine



- **Found where?** Norepinephrine- local coeruleus (dorsal pons), epinephrine- (hormone) adrenal medulla gland (above kidneys), wide projections throughout brain, release at axonal varicosities (diffuse release), very localized production and diffuse projections.
- **Receptors:** Excitatory or inhibitory
Metabotropic: α -adrenergic and β -adrenergic
- **Psychopharmacology:** Vigilance and attention, fusaric acid blocks synthesis of NE from dopamine, reserpine prevents storage of monoamines vesicles (hypertension), idazoxan blocks auto-receptors for example, stops regulation of release

SEROTONIN (5-HT)

- **Synthesis:** Tryptophan (turkey, chocolate, cheese)



- **Found where?** Mainly raphe nuclei (midbrain), 9 kids labeled 5-HT_{xx}
- **Psychopharmacology:** Mood, eating (vomit), sleep (dreams), and pain, PCPA blocks tryptophan, Fluoxetine (Prozac) inhibits 5-HT reuptake, fenfluramine inhibits 5-HT reuptake and stimulate release, appetite suppressor, LSD (acid) is a hallucinogen agonist for 5-HT_{2A} MDMA (ecstasy) inverts reuptake transportation direction-long term deficits, very localized production and diffuse projections.

NEUROPEPTIDES

- **Synthesis:** In soma from amino acids, needs axoplasmic transport, 100 kinds ex.) oxytocin, transmitters: endogenous opioids (endorphins).
- **Found where?** In many regions of CNS and PNS, released at synaptic boutons and by volume transmission ex.) "leaking", co-released with other neurotransmitters (same vesicle), deactivated by enzymes (no reuptake or recycling).
- **Receptors:** Usually inhibitory, many kinds.
- **Psychopharmacology:** Opium, morphine, heroine (opiates) bind to/open opiate receptors, analgesic reinforcers, codeine, cough suppressant converted in liver into morphine, binds to opiate receptors, naloxone competitive blocker of opiate receptors (prevents overdose), angiotensin, PNS constrict blood vessels, CNS thirst.

LIPIDS

- **Synthesis:** anandamide (endocannabinoids)
- **Found where?** Non locally produced on demand not stored in vesicles
- **Receptors:** Excitatory or inhibitory, mainly metabotropic CB1 or CB2
- **Psychopharmacology:** Complex synaptic effects, THC is agonist for CB1 and CB2, analgesic sedative, appetite enhancer, reduces nausea, blocks 5-HT (anti-vomiting), interferes with attention, distorts perception (time and space), impaired learning/memory, possibly addictive at high doses, synthetic THC prescribed for chemo and MS, acetaminophen (Tylenol) acts on CB1 receptor, rimonabant CB1 receptors.

NUCLEOSIDES

- **Synthesis:** Sugar molecule bound to another compound ex.) Adenosine
- **Found where?** Non local, adenosine released by astrocytes provides energy when energy.
- **Receptors:** many, for adenosine: 3 types of receptors, inhibitory through metabotropic k channel triggered by ion energy/low oxygen signals.
- **Psychopharmacology:** Increase blood flow, decrease arousal, caffeine is adenosine receptor blocker, addictive, crosses placenta and blood-brain barrier, fat soluble so passes cell membrane.

SOLUBLE GASES

- **Synthesis:** Nitric oxide within neurons, no storage, carbon monoxide.
- **Found where?** Non local, produced on demand.
- **Receptors:** None diffuse directly into neighboring neurons, triggers second messenger cascades.
- **Psychopharmacology:** modulates intestine function (relaxation), stimulates erection (Viagra-NO inhibitor blocker), involved in learning and memory.

DRUG EFFECTS ON SYNAPTIC TRANSMISSION

