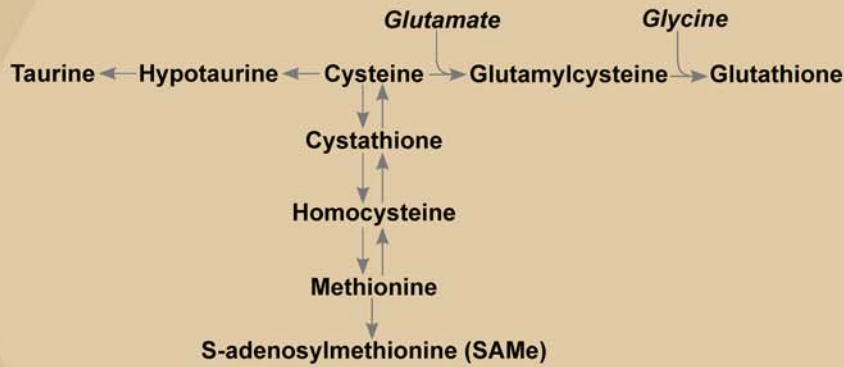
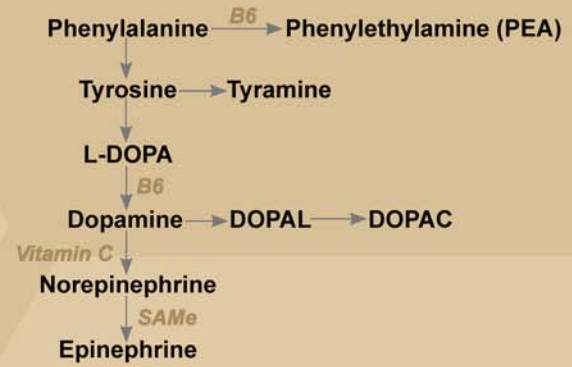


# BIOCHEMISTRY QUICK REFERENCE GUIDE

## Taurine, Cysteine, Methionine, Glutathione Pathway



## PEA, Dopamine, Norepinephrine, Epinephrine Pathway



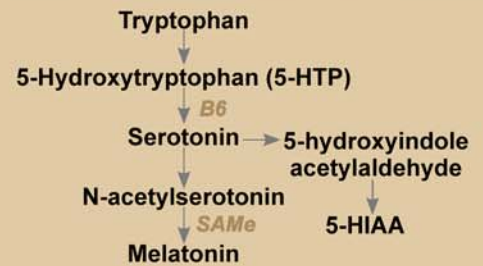
## Histamine Pathway



## Glutamate/GABA Pathway

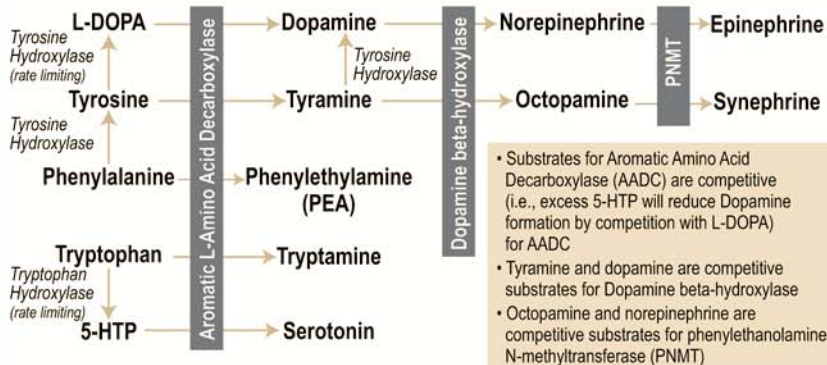


## Serotonin/Melatonin Pathway



Indicates enzymatic cofactors

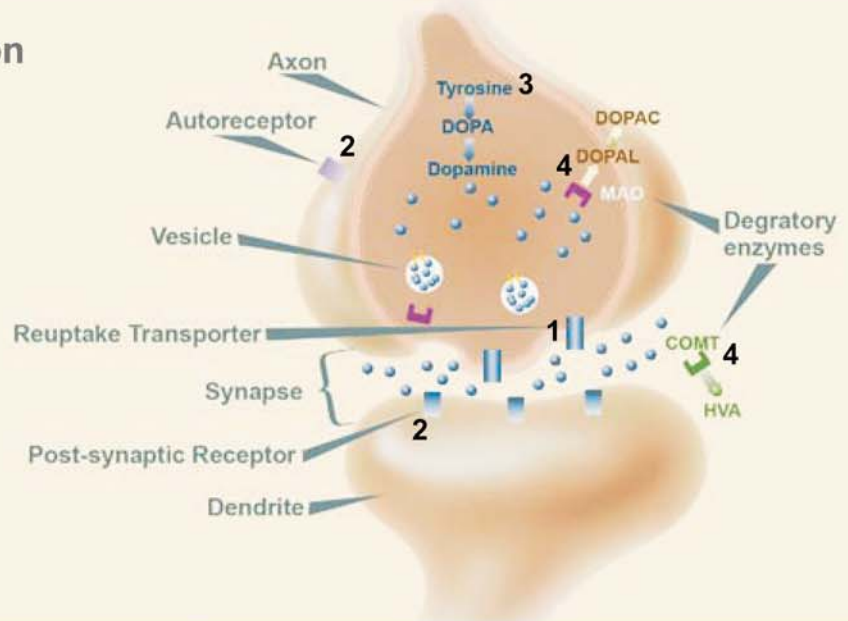
## Monoamine Competitive Substrate Synthesis



Inhibitory Neurotransmitters	Excitatory Neurotransmitters	Neurotransmitter Metabolites
GABA	Glutamate	5-HIAA
Glycine	Norepinephrine	DOPAC
Serotonin	Epinephrine	Tyramine
Taurine	Dopamine	
	Histamine	Neurotransmitter Precursor
	Aspartic Acid	
	PEA	Glutamine

## Psychotropic Points of Intervention

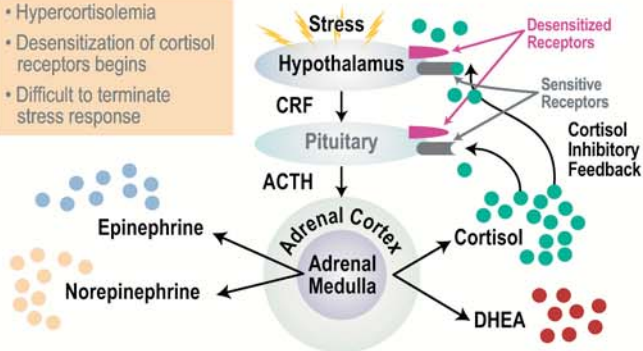
1. **Selective reuptake inhibitors** block the action of transporters that move neurotransmitters from the synapse into the neuron, thereby increasing synaptic levels of the respective neurotransmitter. Examples: SSRIs, SNRIs.
2. **Receptor agonists and antagonists** mimic, enhance, or inhibit the effects of neurotransmitters on receptor binding sites. Example: Benzodiazepines.
3. **Neurotransmitter substrates** enhance the synthesis of neurotransmitters, and thus, availability of neurotransmitter stores. Example: Amino acids.
4. **Enzyme modulators** alter the action of a specific enzyme thereby influencing neurotransmitter levels. Example: Monoamine Oxidase Inhibitors.



# INTERPRETATION QUICK REFERENCE GUIDE

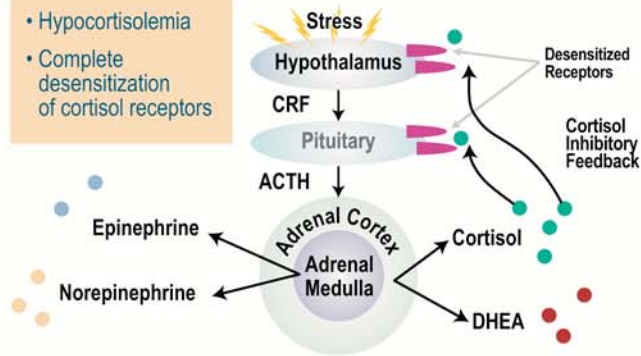
## Early Chronic Stress Response

- Hypercortisolemia
- Desensitization of cortisol receptors begins
- Difficult to terminate stress response



## Late Chronic Stress Response

- Hypocortisolemia
- Complete desensitization of cortisol receptors



## EXCITATORY NEUROTRANSMITTERS

<b>Aspartic Acid:</b> Vital for energy and brain function.	↑ <b>High levels:</b> Seizures, Anxiousness	↓ <b>Low levels:</b> Tiredness, Low mood
<b>Dopamine:</b> Responsible for feelings of pleasure & satisfaction, also muscle control, muscle function, & GI issues.	↑ <b>High levels:</b> Poor intestinal function, Developmental delay, Attention issues	↓ <b>Low levels:</b> Addictions, Cravings
<b>Epinephrine:</b> Important for motivation, energy & mental focus (AKA adrenaline).	↑ <b>High levels:</b> Sleep difficulties, Anxiousness, Attention issues	↓ <b>Low levels:</b> Fatigue, Lack of focus, Difficult weight loss
<b>Glutamate:</b> Primary excitatory neurotransmitter, necessary for learning & memory.	↑ <b>High levels:</b> Anxiousness, Low mood, Seizures, Psychological and immunological symptoms	↓ <b>Low levels:</b> Tiredness, Poor brain activity
<b>Histamine:</b> Helps control sleep-wake cycle, plus energy & motivation.	↑ <b>High levels:</b> Allergic responses, Sleep difficulties	↓ <b>Low levels:</b> Feeling tired
<b>Norepinephrine:</b> Important for mental focus, emotional stability and endocrine function (AKA noradrenaline).	↑ <b>High levels:</b> Anxiousness, Stress, Hyperactivity, High blood pressure	↓ <b>Low levels:</b> Lack of energy, Lack of focus, Lack of motivation, Low mood
<b>PEA:</b> Important for focus and concentration.	↑ <b>High levels:</b> Mind racing, Sleep difficulties, Anxiousness	↓ <b>Low levels:</b> Difficulty paying attention, Difficulty thinking clearly, Low mood

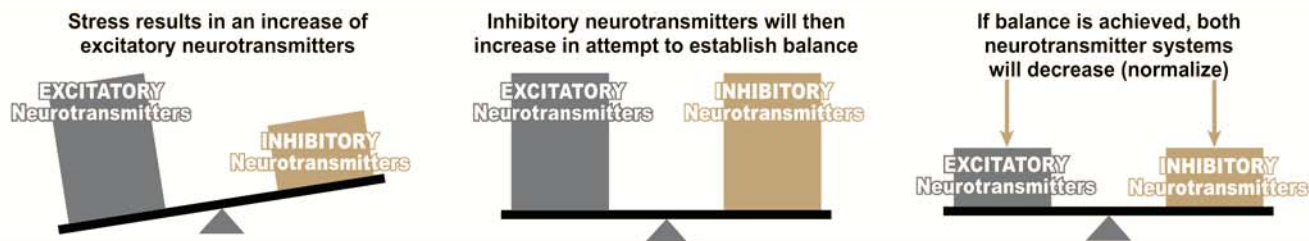
## INHIBITORY NEUROTRANSMITTERS

<b>GABA:</b> Primary inhibitory neurotransmitter in the brain, necessary to feel calm and relaxed.	↑ <b>High levels:</b> Hyperactivity, Anxiousness, Sleep difficulties	↓ <b>Low levels:</b> Uncontrolled hyperactivity, Uncontrolled anxiousness, Uncontrolled sleep difficulties
<b>Glycine:</b> Like GABA, helps calm & relax the body.	↑ <b>High levels:</b> Anxiousness, Low mood, Stress-related symptoms	↓ <b>Low levels:</b> No associated clinical symptoms to date.
<b>Serotonin:</b> Plays important roles in the resolution of mood, sleep, and appetite.	↑ <b>High levels:</b> SSRI medications	↓ <b>Low levels:</b> Low mood, Sleep difficulties, Uncontrolled appetite, Headaches, Hot flashes
<b>Taurine:</b> Important for proper heart function, healthy sleep and promoting calmness.	↑ <b>High levels:</b> Hyperactivity, Anxiousness, Sleep difficulties	↓ <b>Low levels:</b> Uncontrolled hyperactivity, Uncontrolled anxiousness, Uncontrolled sleep difficulties

## OTHER PARAMETERS

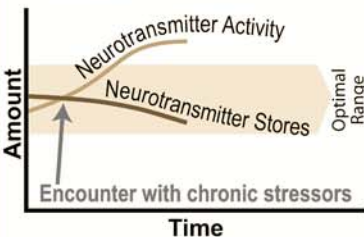
<b>5-HIAA:</b> 5-Hydroxyindoleacetic acid is the primary metabolite of serotonin involving monoamine oxidase A (MAO-A) and aldehyde dehydrogenase.	↑ <b>High levels:</b> Intestinal complaints	↓ <b>Low levels:</b> Impulsivity, Sleep difficulties, Low mood, Cravings, Urges
<b>Creatinine:</b> A normalizing parameter used to calculate neurotransmitter levels. Produced by the kidneys at a constant rate, therefore, by using creatinine as a constant factor, urinary measurements can be performed without having to factor in the patient's hydration state, possible renal disorders, or diuretic substances.		
<b>DOPAC:</b> A critical metabolite of dopamine	↑ <b>High levels:</b> Hyperactivity, Focus issues, Developmental delay	↓ <b>Low levels:</b> No associated clinical symptoms to date.
<b>Glutamine:</b> An amino acid made into GABA and glutamate. Optimal glutamine levels are important for intestinal function. High glutamine levels are thought to be a signal for imbalances within the nervous system.		

## Inhibitory/Excitatory Concept of Neurotransmission

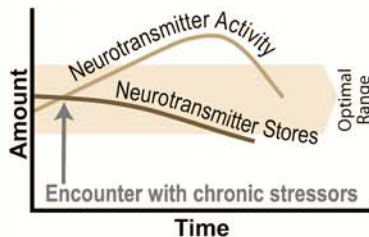


## Effect of Chronic Stress on Neurotransmitter Activity and Stores

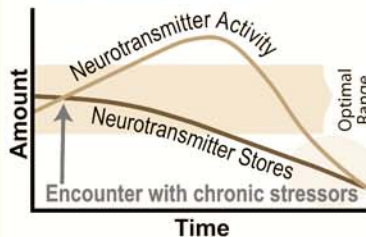
1 Encounter with Chronic Stress; Neurotransmitter Activity Increases.



2 Neurotransmitter Activity May Look Optimal, Stores Begin To Deplete.



3 Inadequate Neurotransmitter Stores Lead to Inadequate Neurotransmitter Activity.



4 Inadequate Neurotransmitter Activity May Lead to Symptom Development.

