

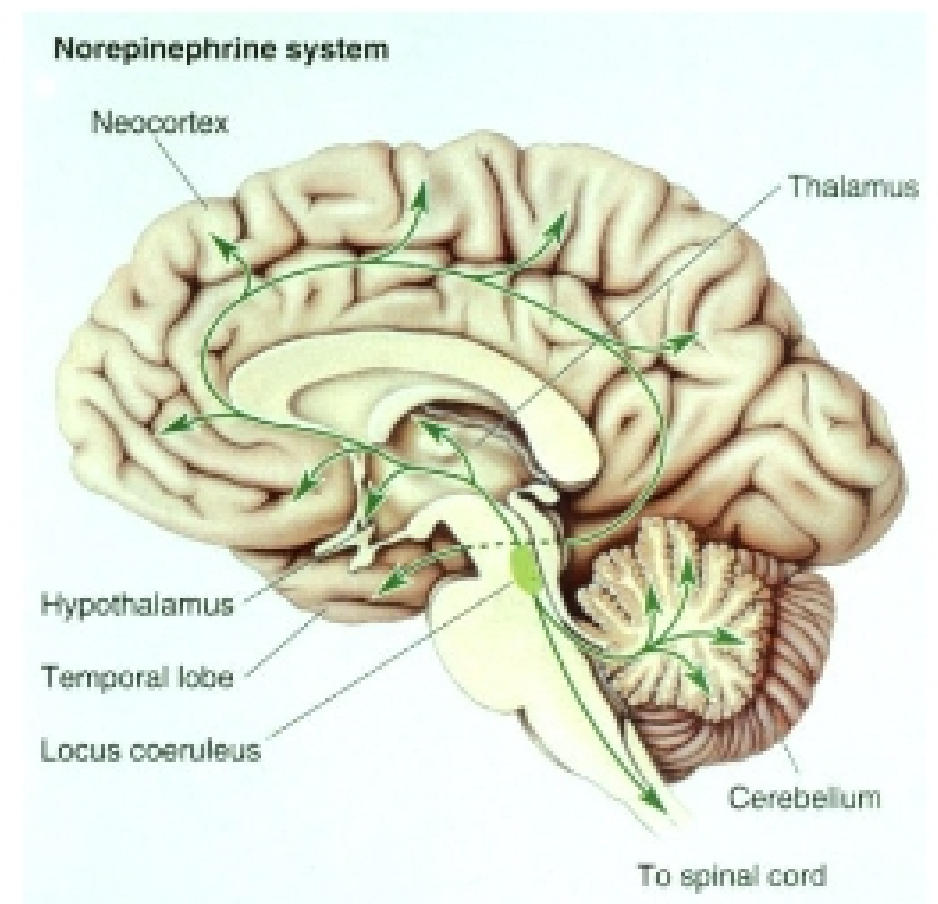
NEUROTRANSMITTERS

Acetylcholine: LEARNING AND MEMORY

- Location
 - Basal Nuclei
- Pathways
 - Frontal, parietal, occipital cortexes
 - Hippocampus
 - Medial septal nucleus
- Made from diet
 - Acetyl from sugar
 - Choline from diet; lecithin
- Functions
 - Movement, sensation, judgment, vision, reward, memory, pain, coordination
- Malfunction
 - Alzheimer's

Norepinephrine: AROUSAL

- Location
 - Locus Coeruleus
- Pathways
 - Everywhere
- Made through multiple steps
 - Tyrosine → DOPA → Dopamine → Norepinephrine
- Released by
 - Any stimulant
 - Amphetamines, epinephrine, cocaine, caffeine
- Function
 - Brain's "ON" switch
 - Locus coeruleus regulates arousal level
 - Increase in acetylcholine, glutamate, sensory stimuli, external signals
 - Decrease in serotonin, endorphins, GABA, sleep, internal signals
 - Control fat metabolism

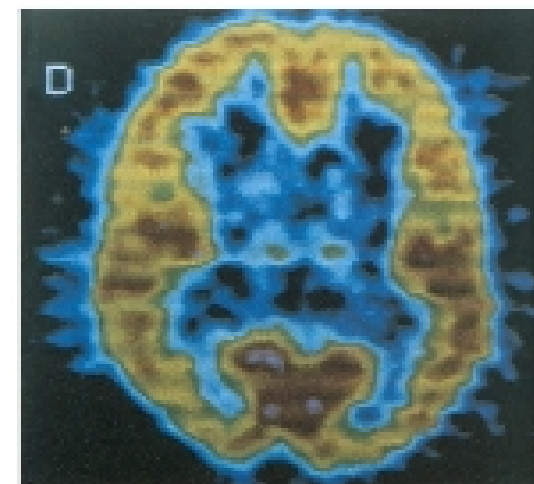


Serotonin: SLEEP, DREAMING, & MOODS

- Location
 - Raphe Nuclei (medial brain stem)
 - Ecstasy destroys this
- Pathways
 - Everywhere
- Made from Tryptophan in diet
 - Dietary tryptophan → L-tryptophan → 5-HTP → Serotonin
- Function
 - Most active during wake
 - Not on during REM
- Malfunctions
 - Hallucinogens turn off serotonergic neurons by 5HT-1A receptors
 - Produce synesthesia
 - Senses mixing
 - Anxiety/Depression
 - Increased levels of P11 protein linked to antidepressants

GABA: INHIBITION

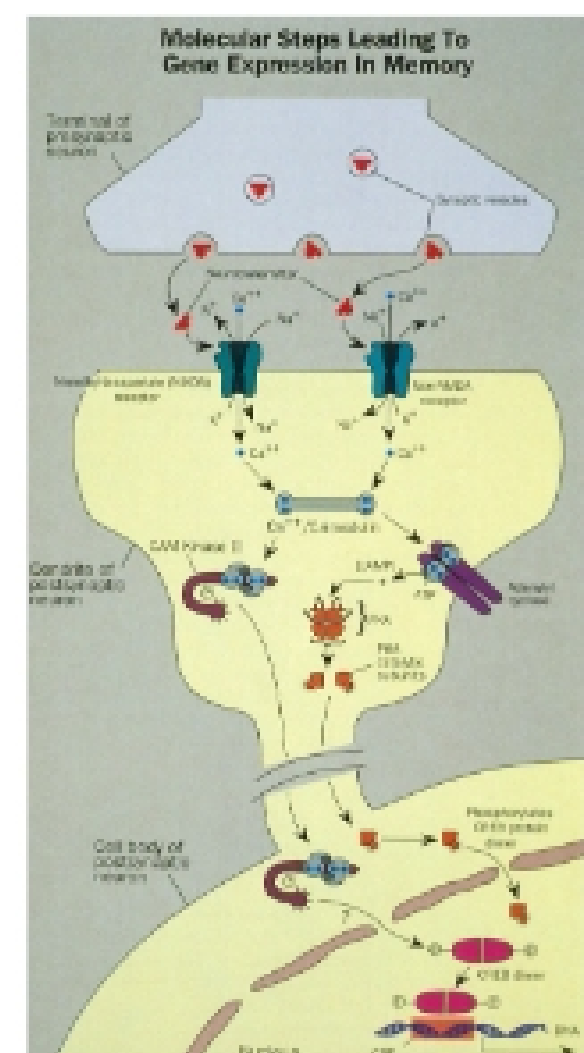
- Location
 - Wide distribution in brain
- Made from glutamate from MSG
- Function
 - Produces IPSP's
 - Opens chloride ion channels
 - So does alcohol/barbiturates
 - Allows sodium to flow in during AP
 - Controls anxiety effects of alcohol, barbiturates, benzodiazepines



16.19 Distribution of Benzodiazepine Receptors
PET scan of benzodiazepine receptors showing their wide distribution in the brain. Highest concentrations are coded as orange and red. Courtesy of Göran Sedvall.

Glutamate: NEUROPLASTICITY

- Location
 - Glutamate receptors
- Physiological
 - Fast synaptic transmission
 - Developmental plasticity
 - Learning and memory
 - Epilepsy
- Pathological
 - Symptomatic



- Chronic pain, drug tolerance/addiction, alcohol abuse, anxiety, depression, schizophrenia
 - Chronic Neuroplasticity
 - Alzheimer's, Huntington's, Parkinson's, Moto neuron disease
 - Acute Neuroplasticity
 - Hypoxia, stroke, trauma, hypoglycemia, toxins
- Mutations
 - PCP blocks channels
 - Related to schizophrenia via alterations in Dysbindin

Dopamine: REWARD

- Location
 - Substantia nigra (superior stem)
 - Pathway: Striatum
 - Ventral tegmental area (ventral superior stem)
 - Pathway: Frontal Lobe
- Made by multiple steps
 - Diet → tyrosine → DOPA → Dopamine
- Malfunctions
 - Cocaine blocks reuptake
 - Schizophrenia
 - Too much dopamine
 - ADHD
- Functions
 - All rewarding things activate dopamine
 - Endogenous Marijuana
 - Anandamide "internal bliss"
 - Chocolate
 - CNS Cannabinoid system