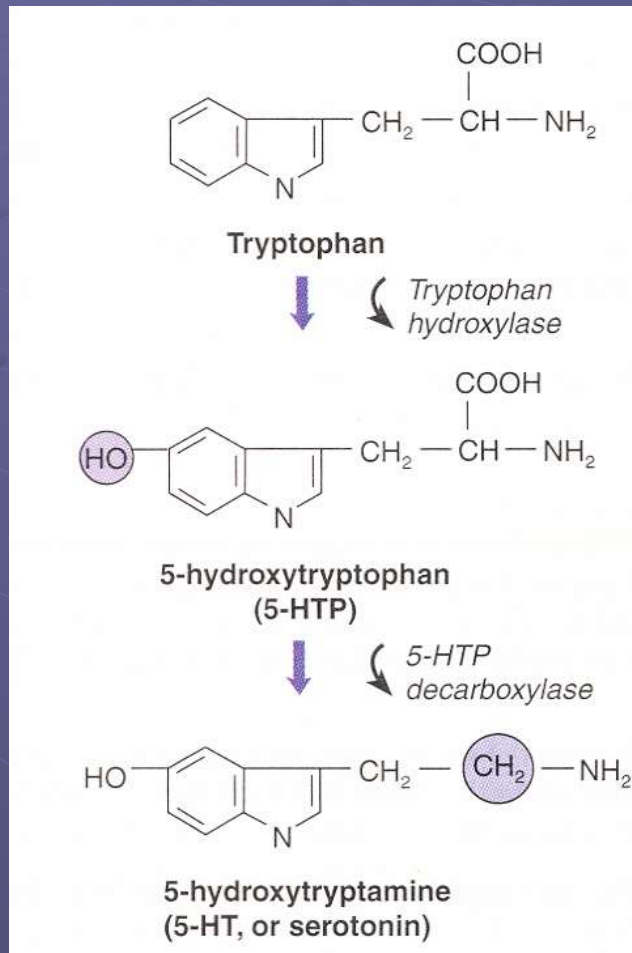


# Serotonin



- Monoamine transmitter formed from tryptophan (5-hydroxytryptophan)
- Plays a major role in sexuality, depression (with elevated risk of suicide), bipolar disorder, and anxiety

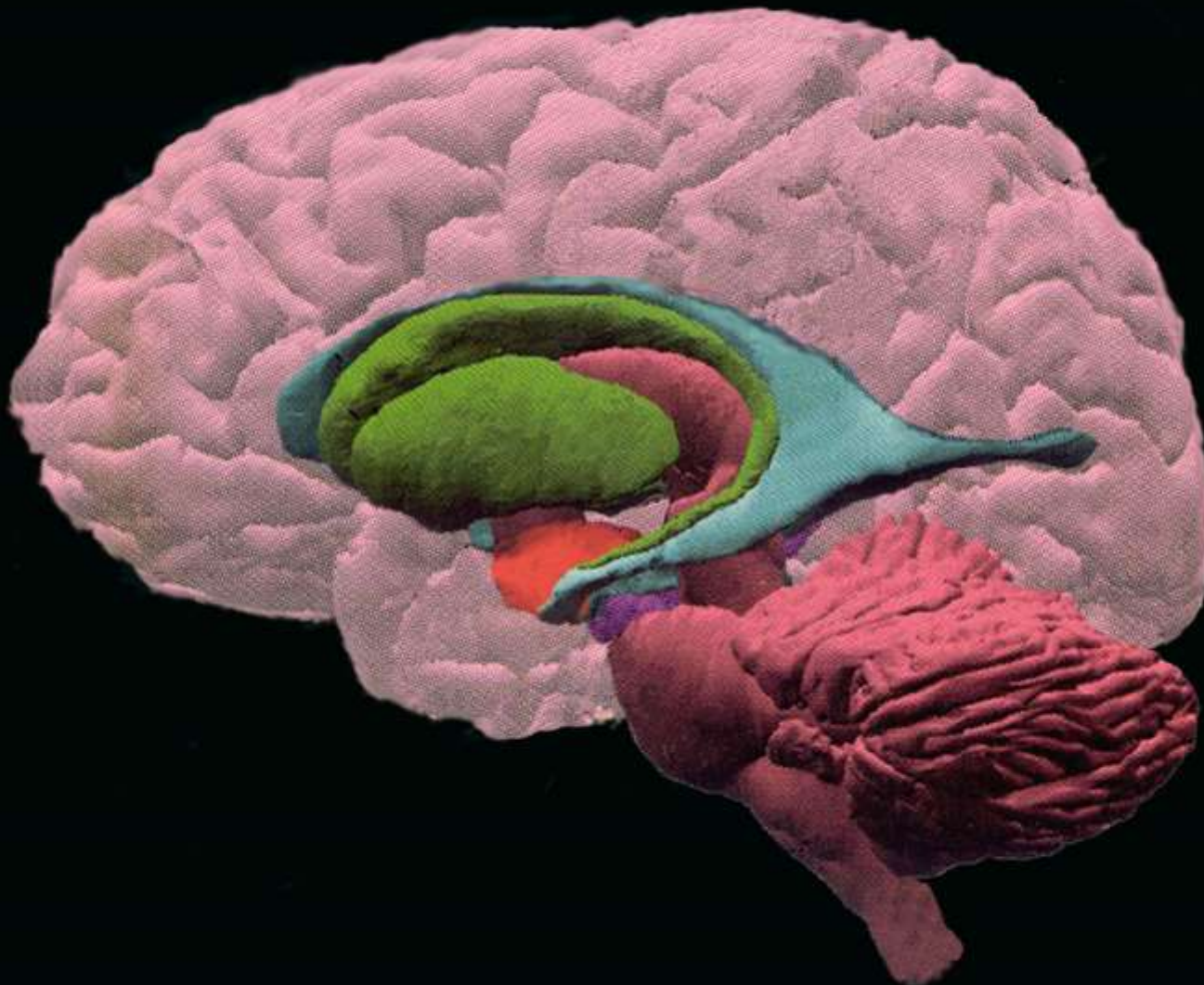
# Serotonin

- Disruption affects the **suprachiasmatic nucleus** (circadian rhythm)
- Predominantly produced in the **raphe nuclei**, of which the **caudal raphe nuclei** project to the **medulla and spinal cord** and play a role in the regulation of pain
- The **rostral raphe nuclei** project to the **limbic system and cerebral cortex**, and serotonin here is colocalized with norepinephrine

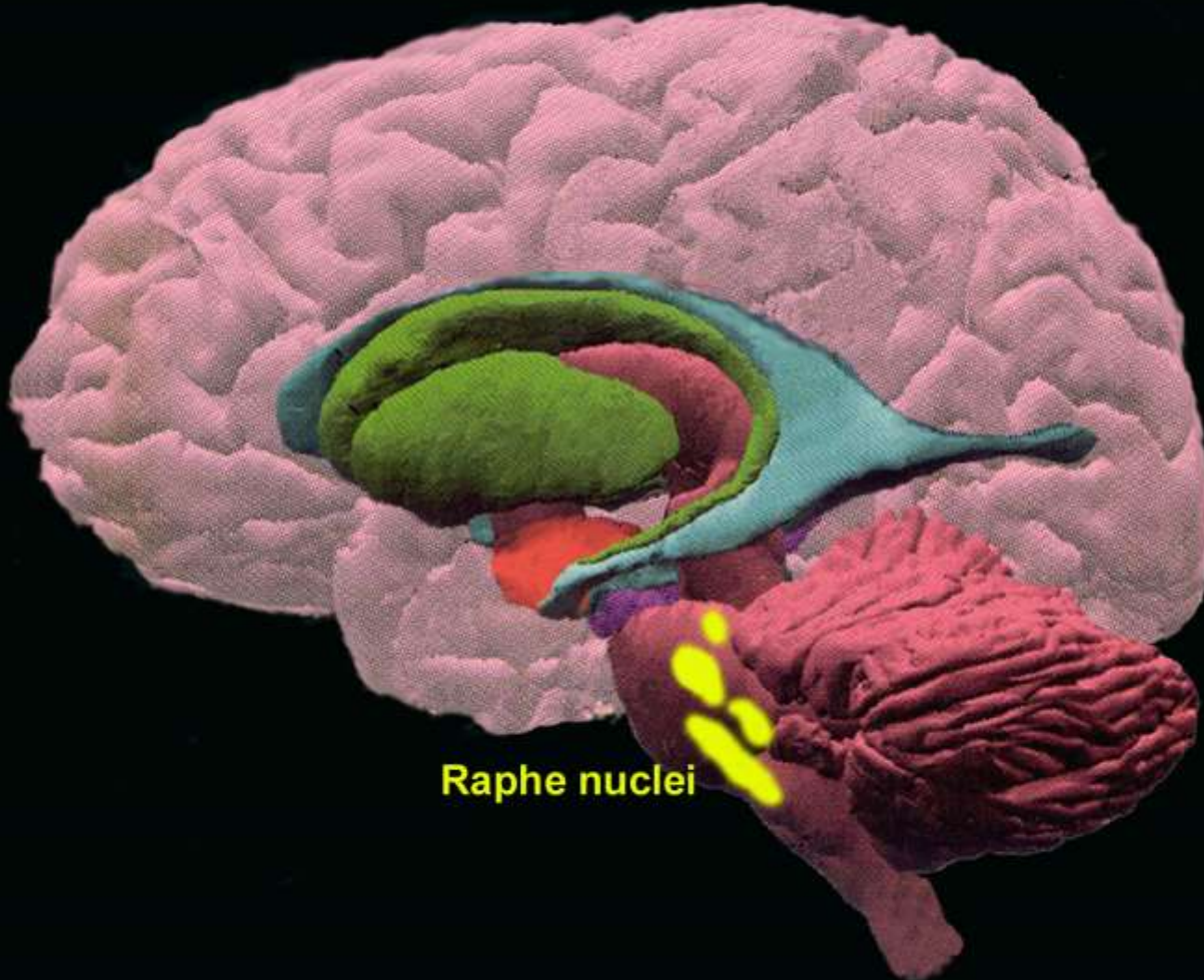
# Serotonin



# Serotonin

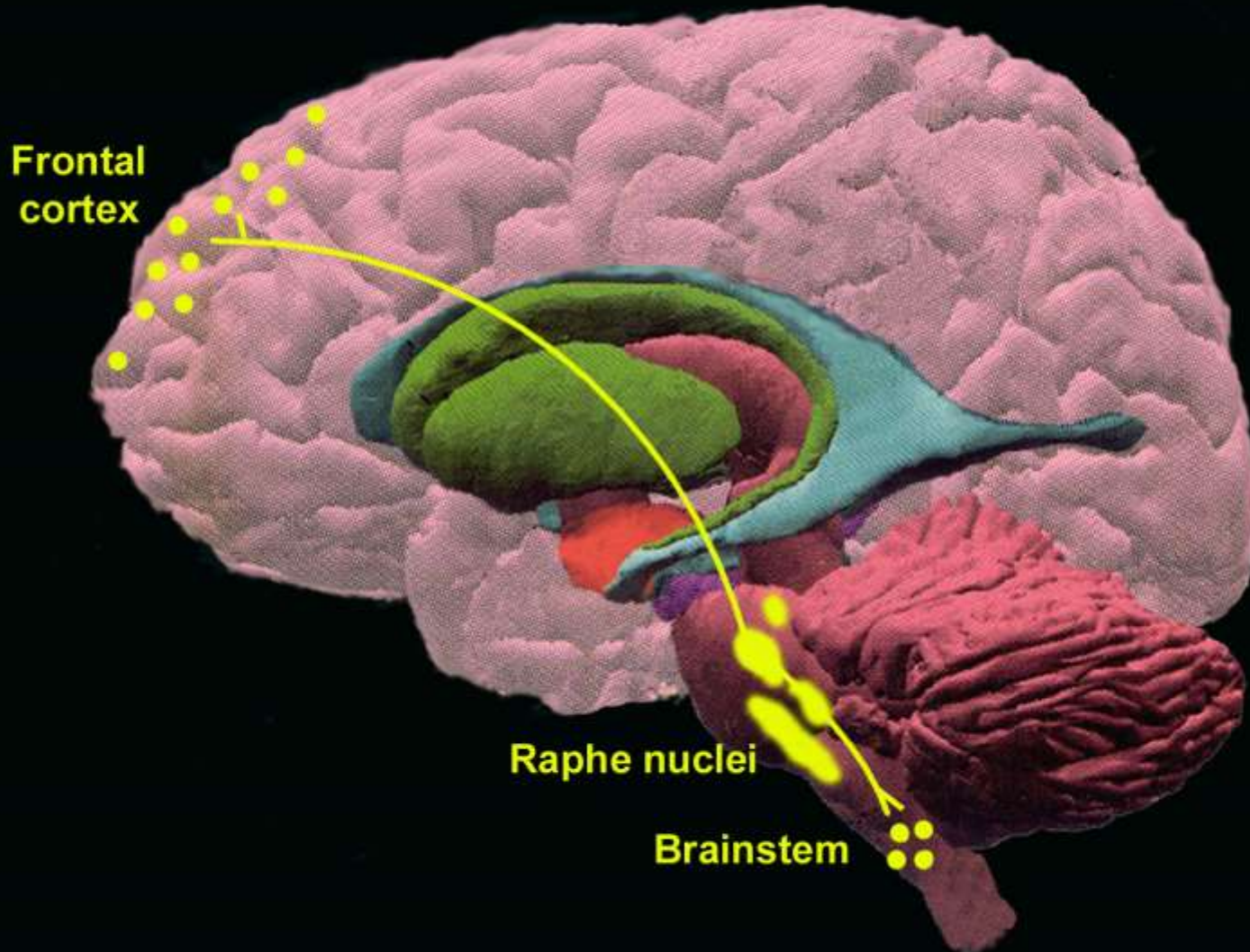


# Serotonin

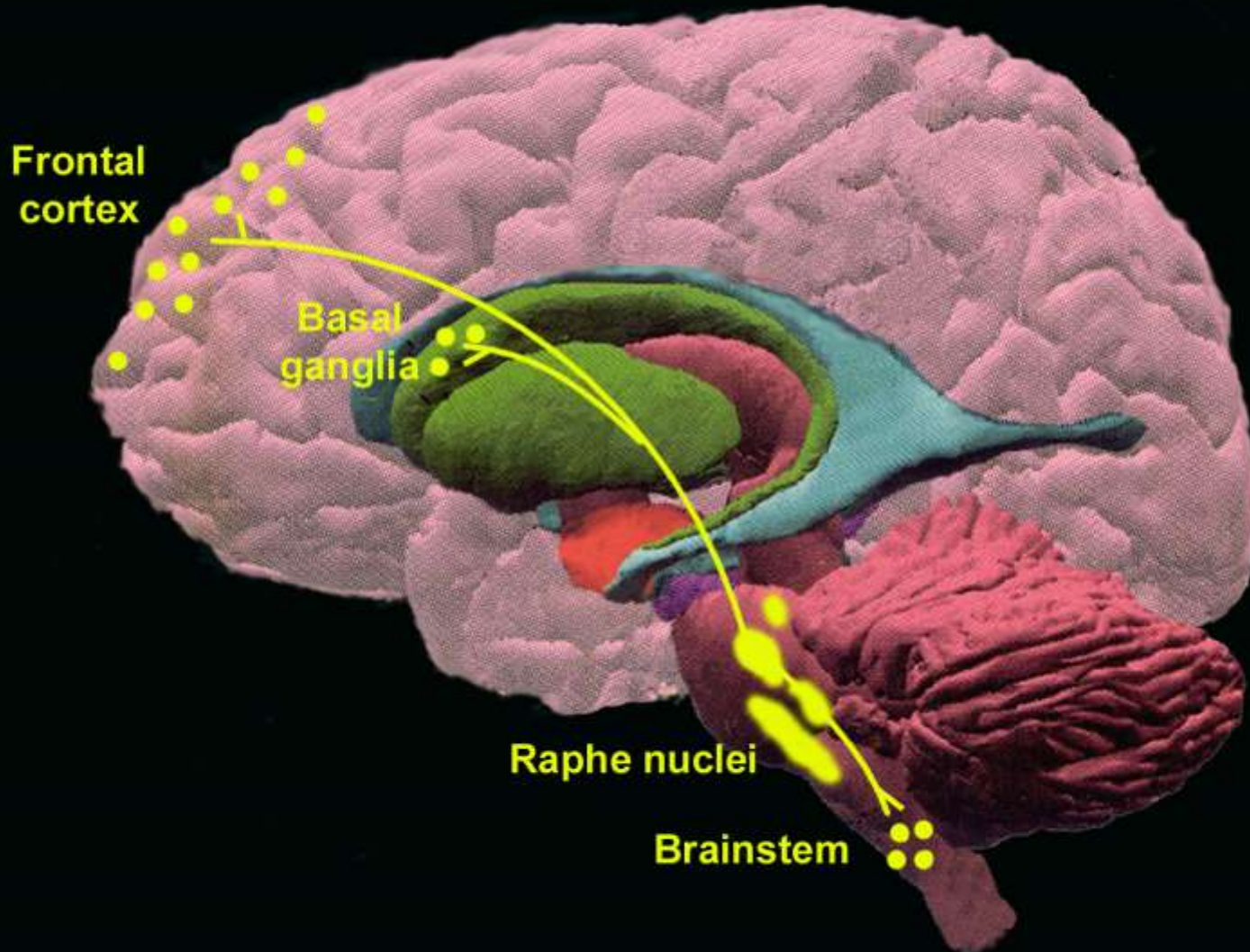


Raphe nuclei

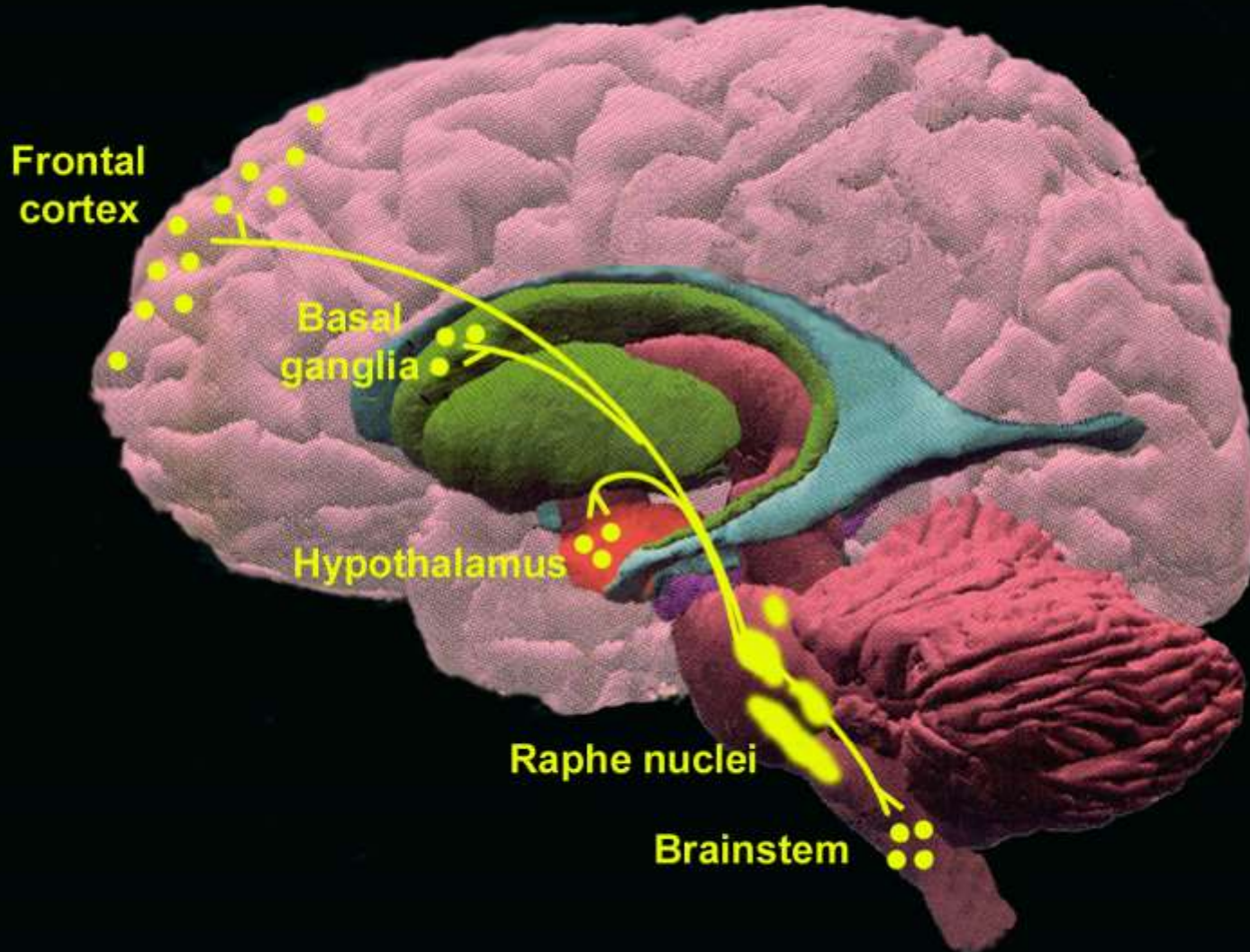
# Serotonin



# Serotonin

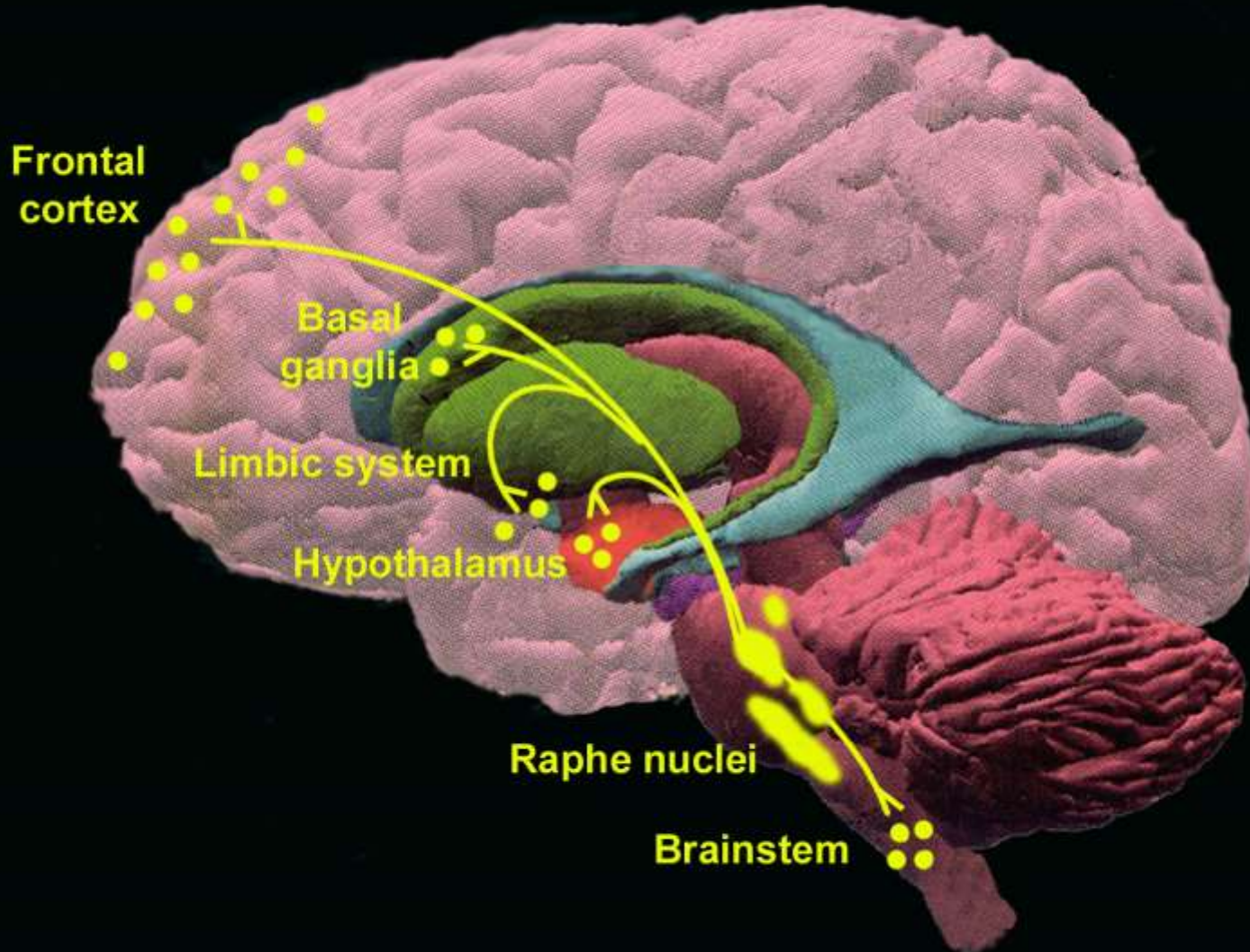


# Serotonin





# Serotonin

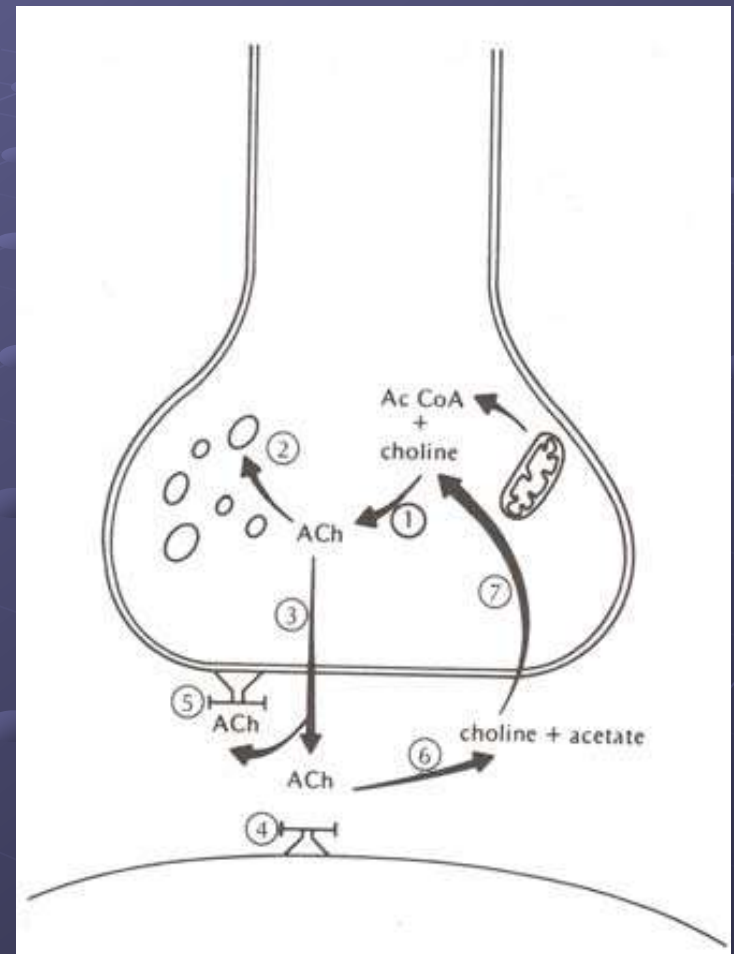


# Serotonin Receptors

- 5-HT1 - **Brain**, intestinal nerves - Neuronal inhibition, behavioral effects, cerebral vasoconstriction
- 5-HT2 - **Brain**, heart, lungs, smooth muscle control, GI system, blood vessels, platelets - Neuronal excitation, vasoconstriction, behavioral effects, depression, anxiety
- 5-HT3 - **Limbic system**, ANS - Nausea, anxiety
- 5-HT4 - **CNS**, smooth muscle - Neuronal excitation, GI
- 5-HT5, 6, 7 – **Brain** – Depression

# Acetylcholine

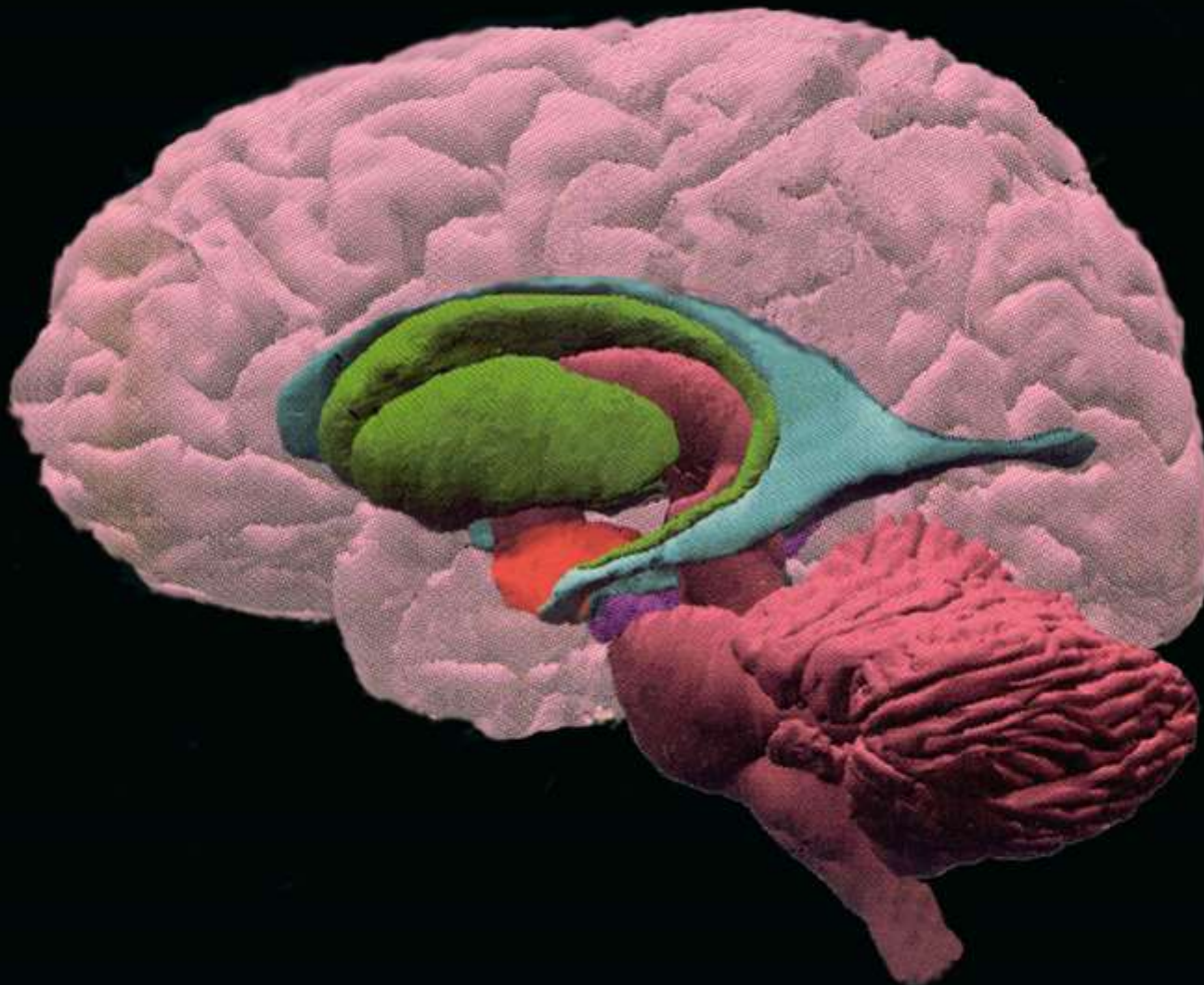
- First neurotransmitter described
- Derived from acetyl + choline
- Important role in myasthenia gravis at the neuromuscular junction
- Decreased in Alzheimer disease (may be partially reversed with rivastigmine)
- Pentameric receptor in muscles (two alpha, one beta, delta, and gamma subunits), tetrameric in CNS (two alpha, two beta)



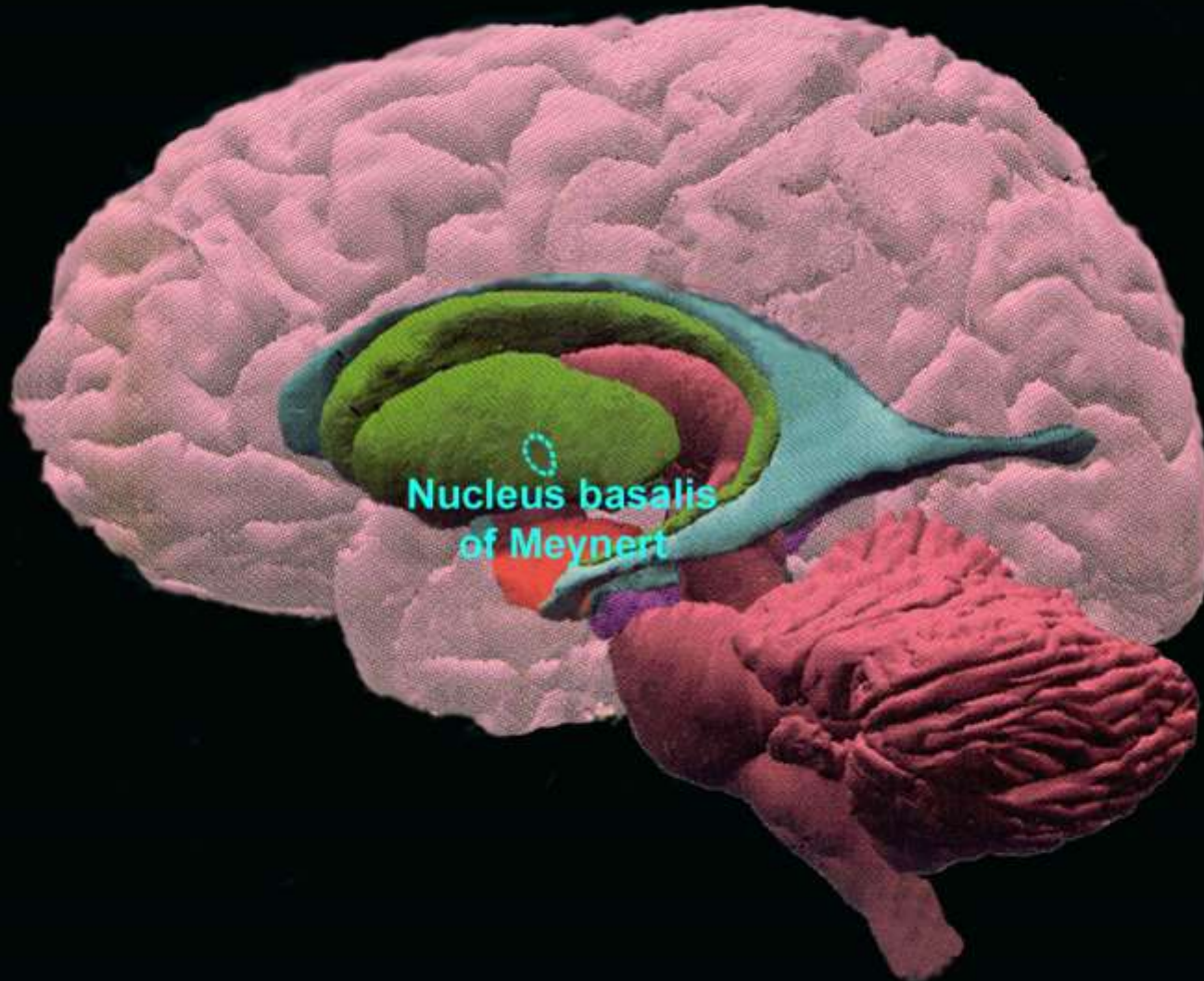
# Acetylcholine



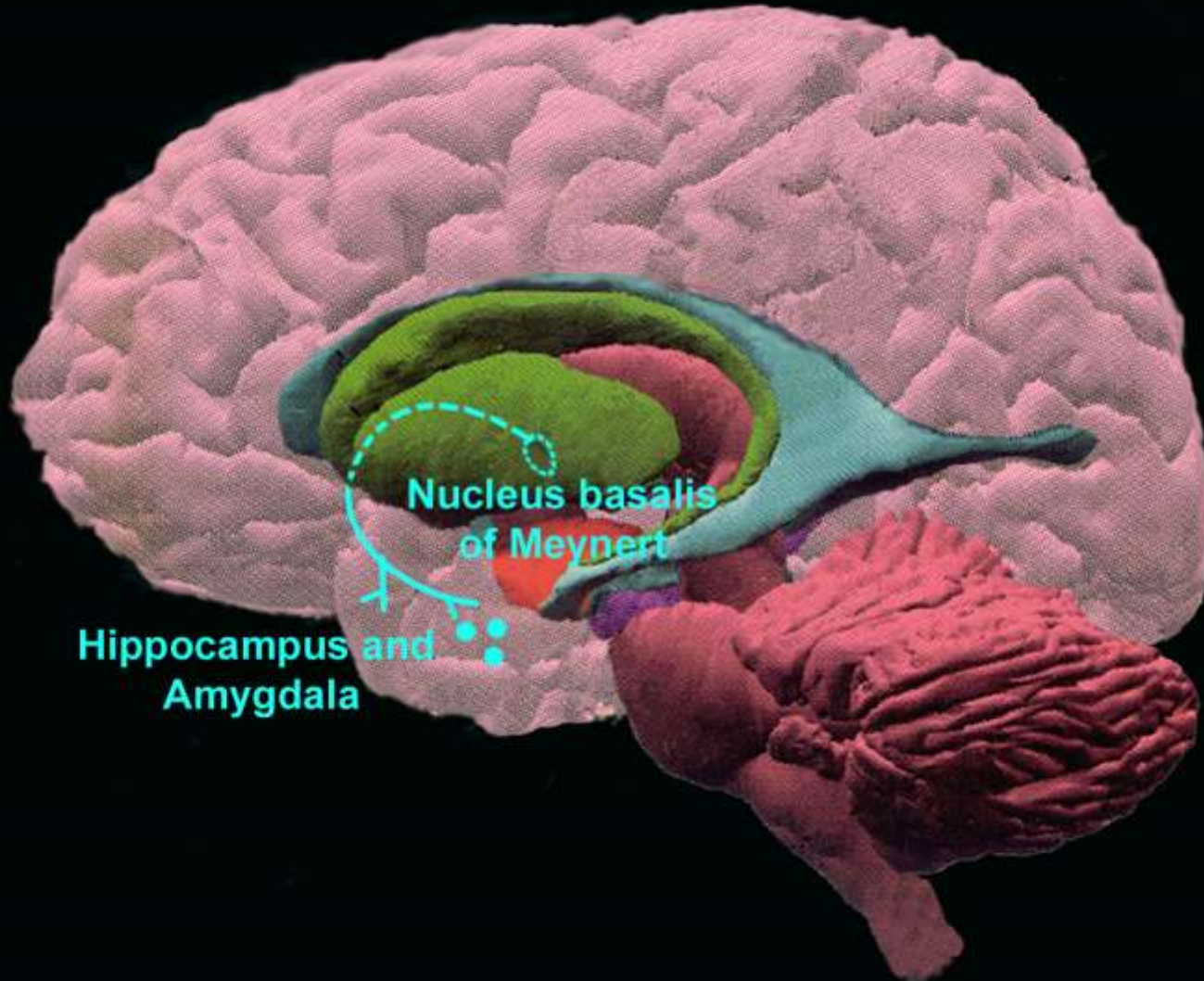
# Acetylcholine



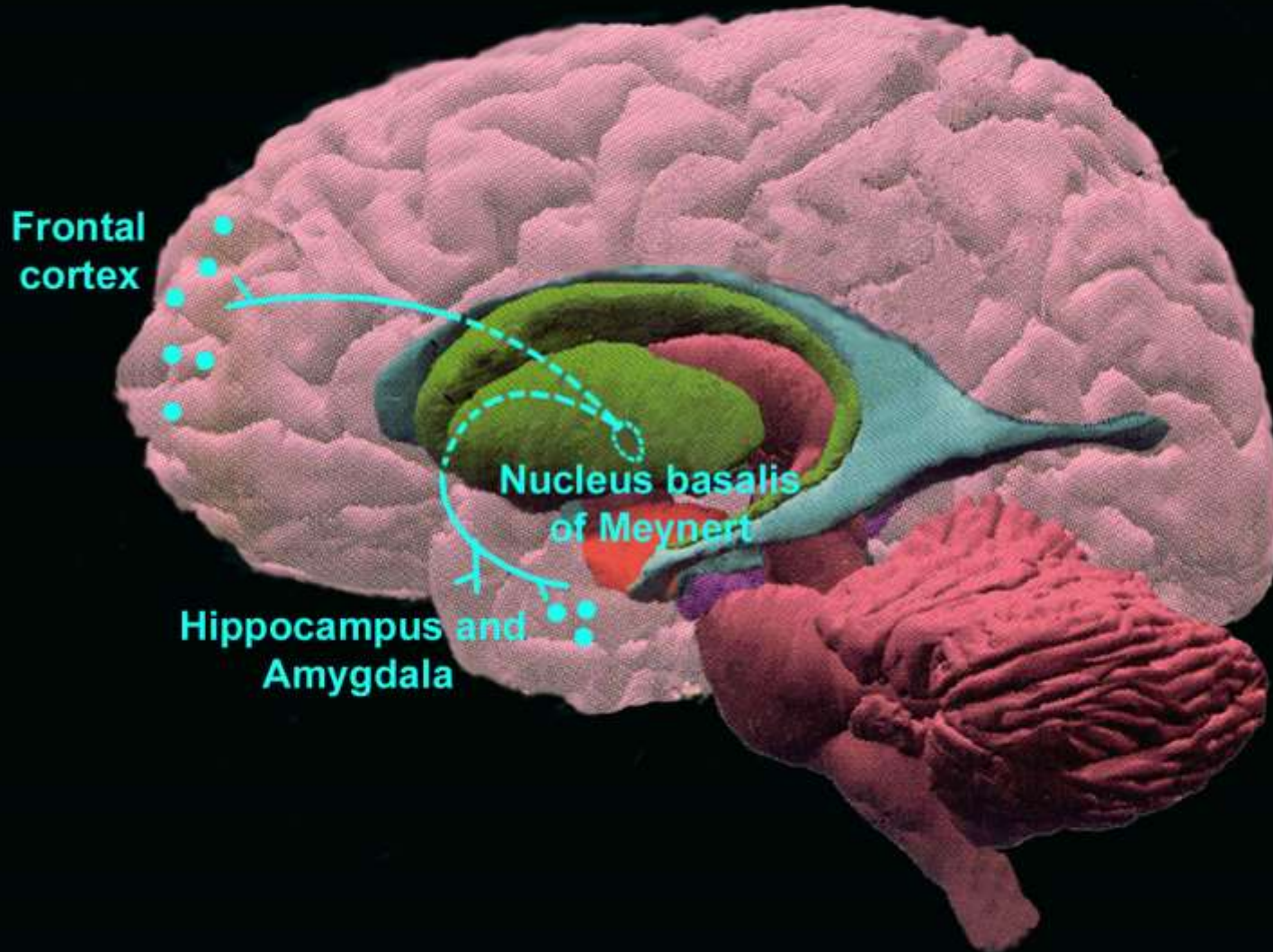
# Acetylcholine



# Acetylcholine

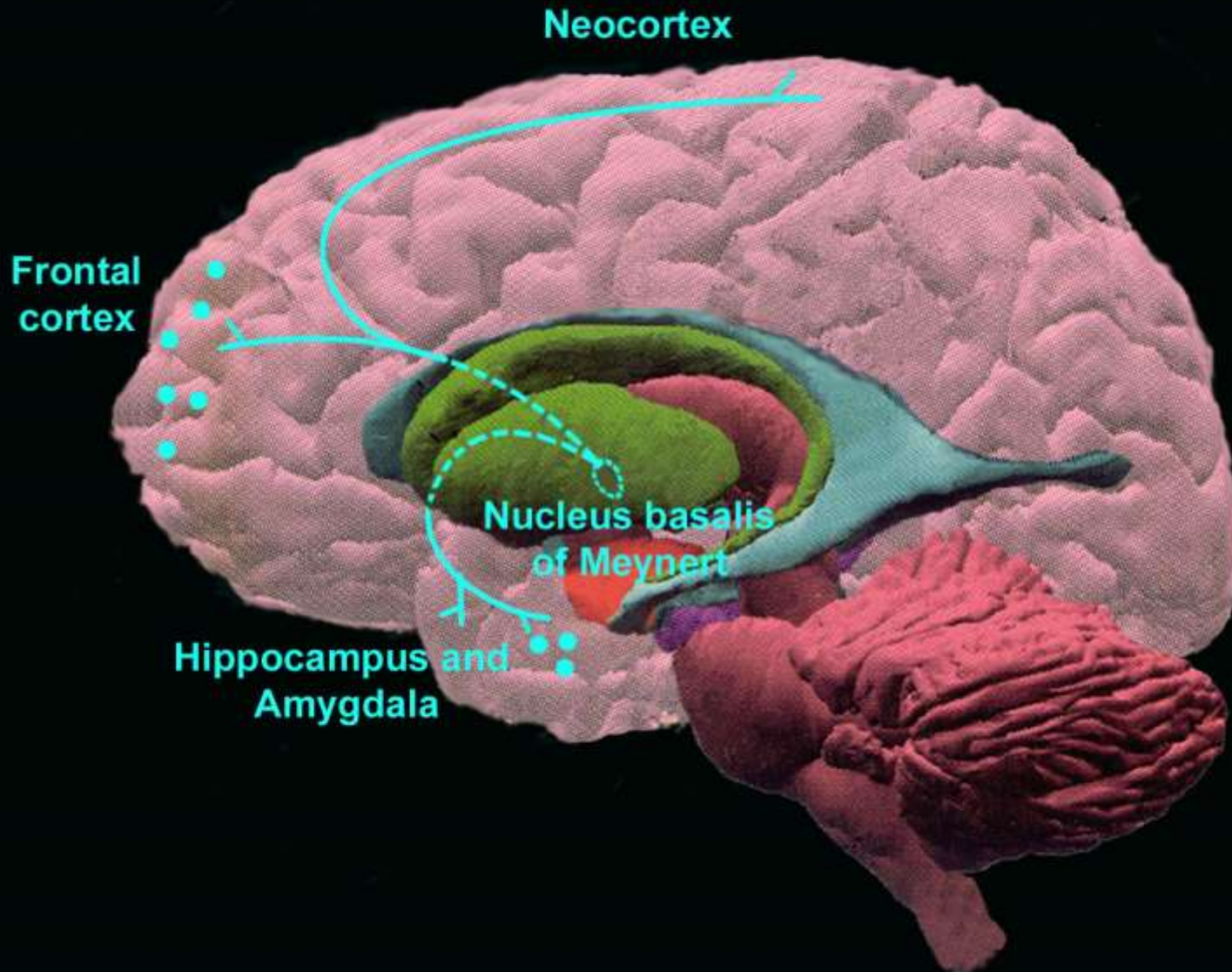


# Acetylcholine





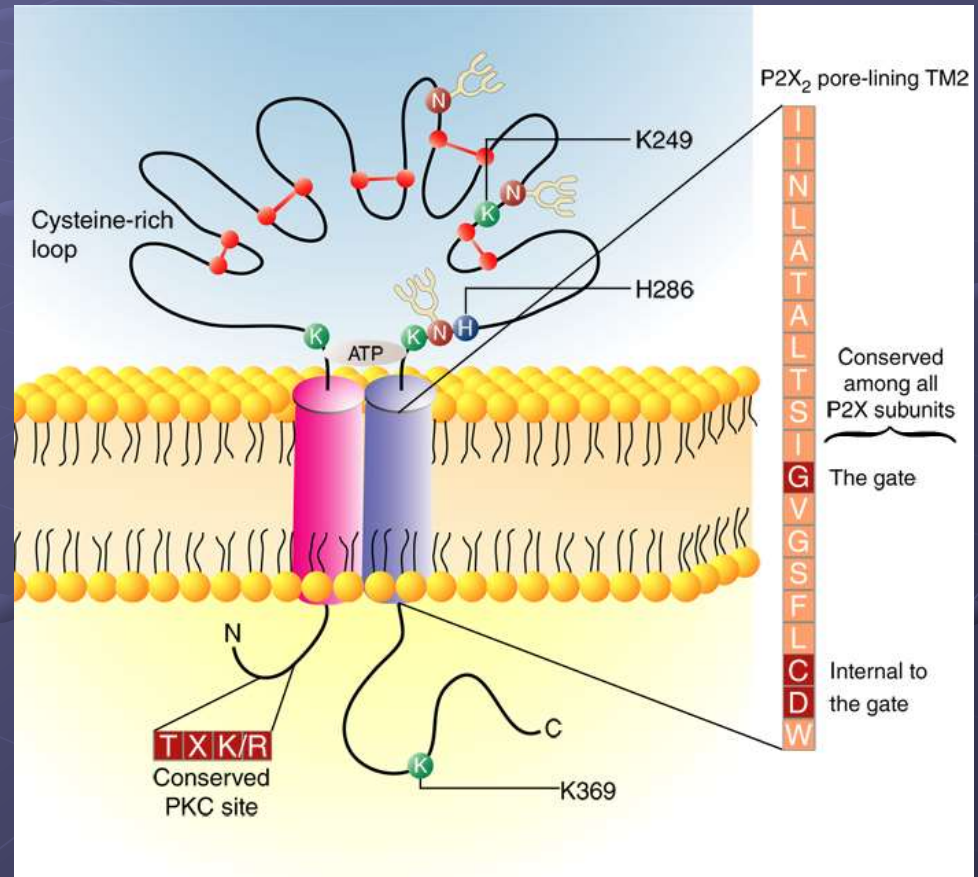
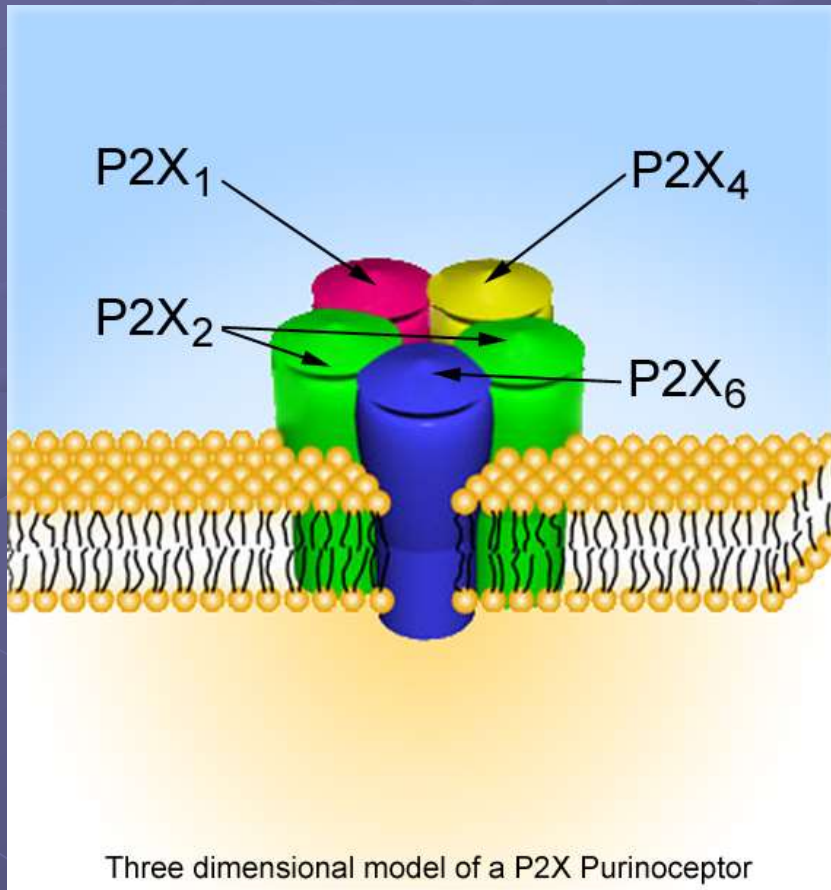
# Acetylcholine



# Acetylcholine Receptors

- M1 - Nerves - CNS excitation, gastric acid secretion
- M2 - Heart, nerves, smooth muscle - Cardiac inhibition, neural inhibition
- M3 -Glands, smooth muscle, endothelium - Smooth, muscle contraction, vasodilation
- M4 – CNS - Not known
- M5 – CNS - Not known
- NM - Skeletal muscles neuromuscular junction - Neuromuscular transmission
- NN - Postganglionic cell body dendrites - Ganglionic transmission

# Acetylcholine Receptors



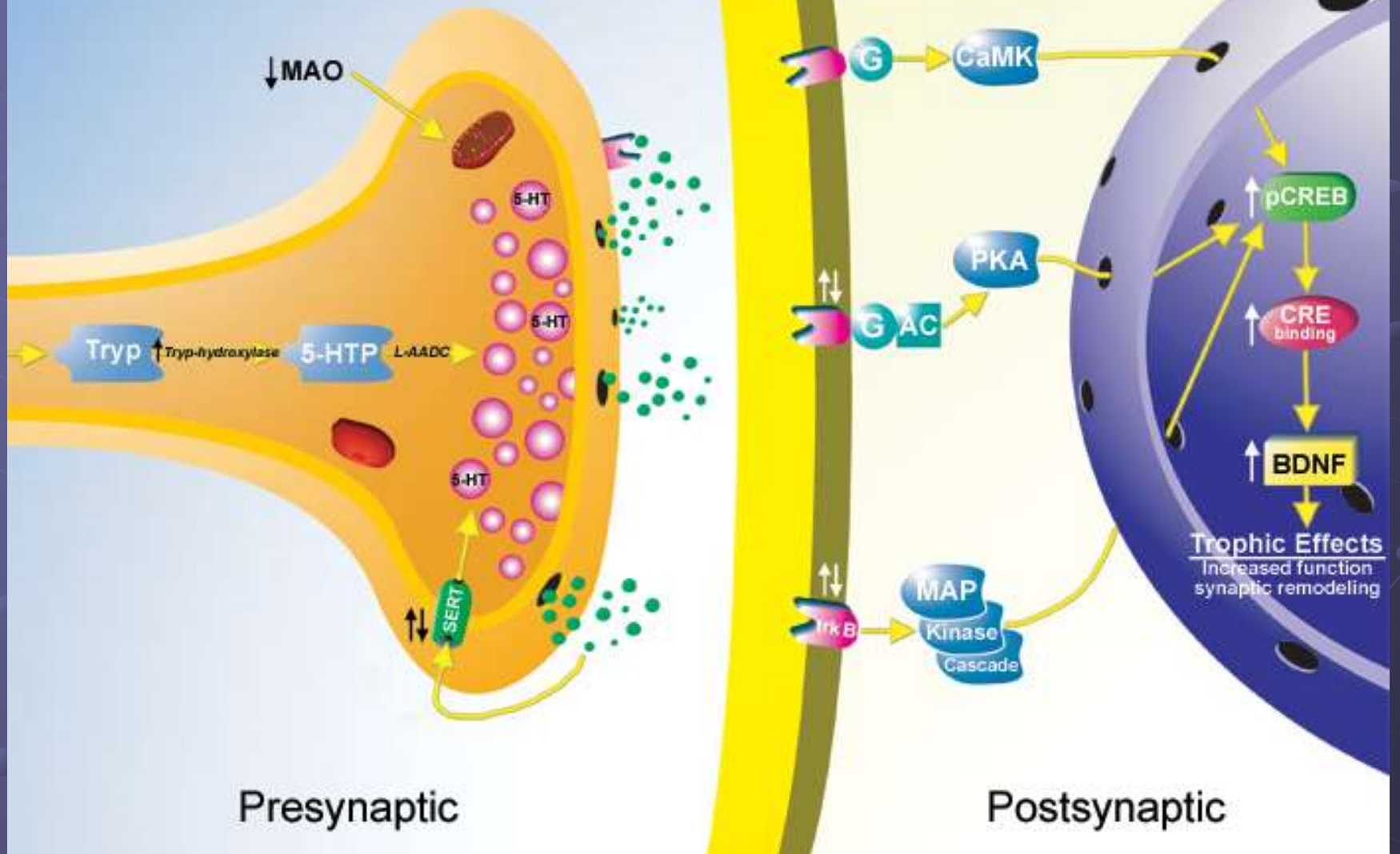
A 3D grid of spheres on a blue background. The spheres are arranged in a regular, repeating pattern, creating a perspective effect that recedes into the distance. The spheres are light blue and have a slight shadow, giving them a three-dimensional appearance. The background is a solid, darker blue color.

Not a Simple Picture

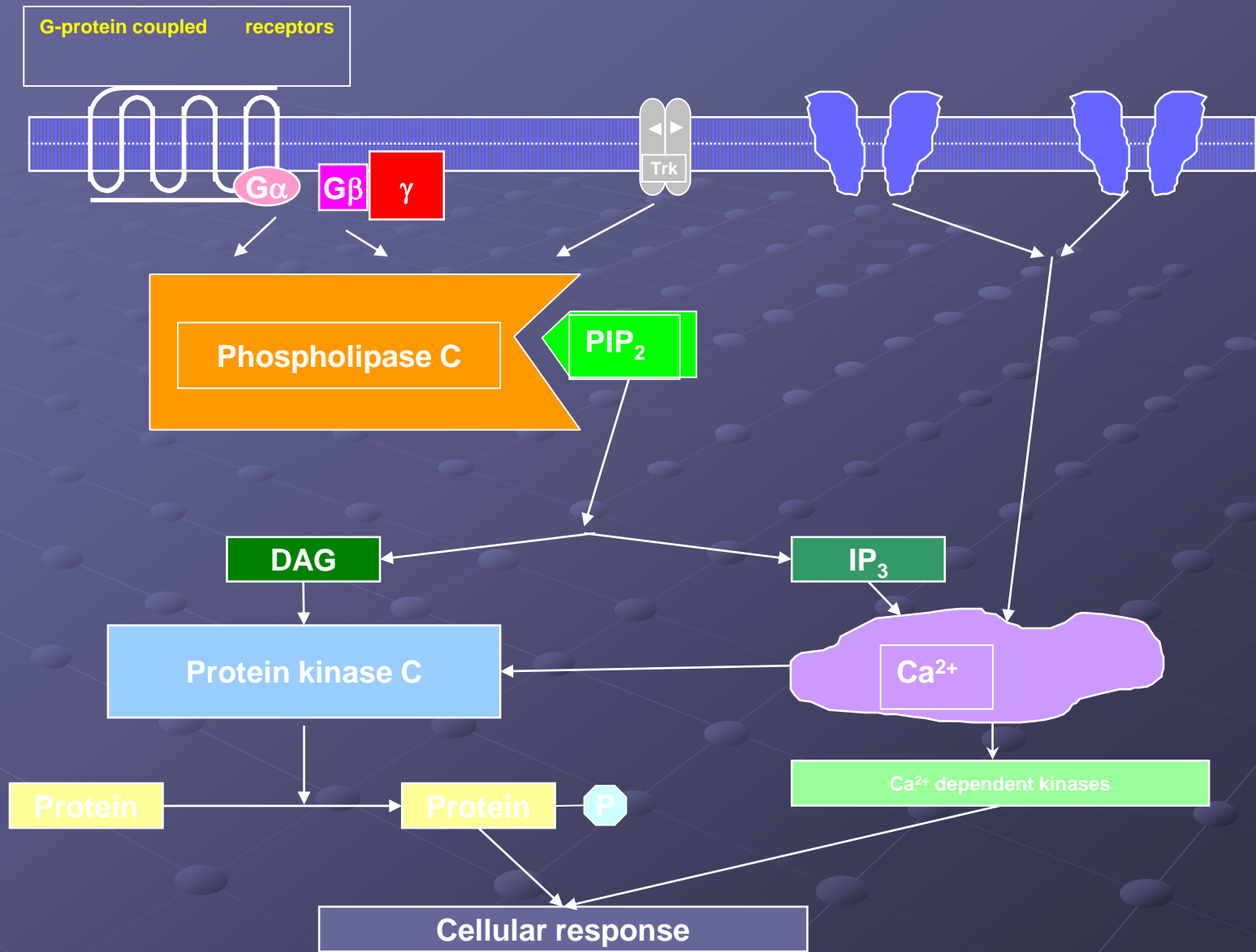
# Signaling Paradigm

- Neurotransmitter signaling is not simply a one neurotransmitter – one response paradigm.
- Instead, it consists of multiple neurotransmitters each acting through multiple second messenger pathways to create immediate effects and long-term potentiation.
- The time course and frequency of stimulation affects the degree of long-term potentiation and synaptic modeling.

# Antidepressants and Estrogen Have Common Mechanisms of Action



# PHOSPHOINOSITIDE SIGNALING PATHWAY



# Neural mechanisms of synaptic plasticity, short and long-term memory

