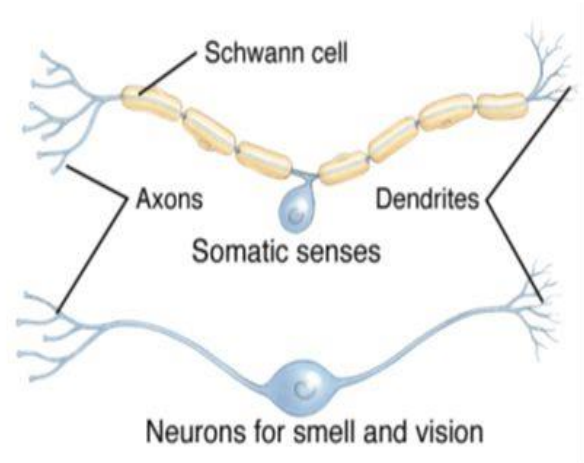
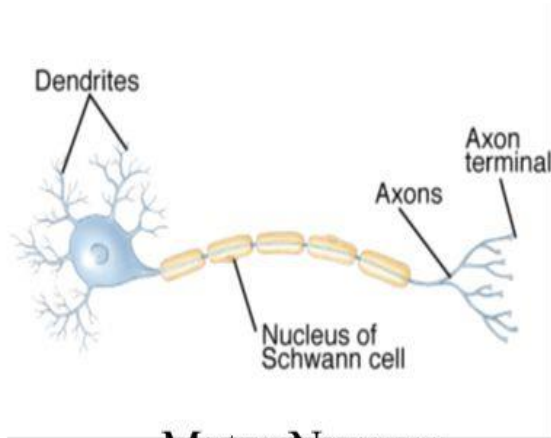
روانشناسی پزشکی و نوروپسیکولوژی، جلسه پنجم

پردازش مغزی اطلاعات (قسمت اول، نورونهای واسطه ای و مدارهای نورونی)

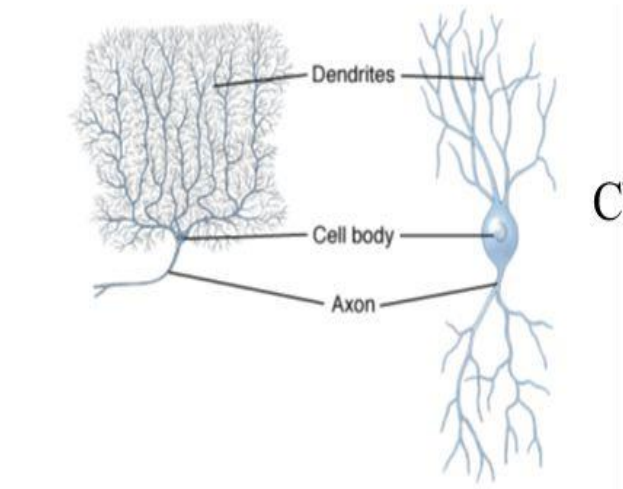
Three Functional Types of Neurons



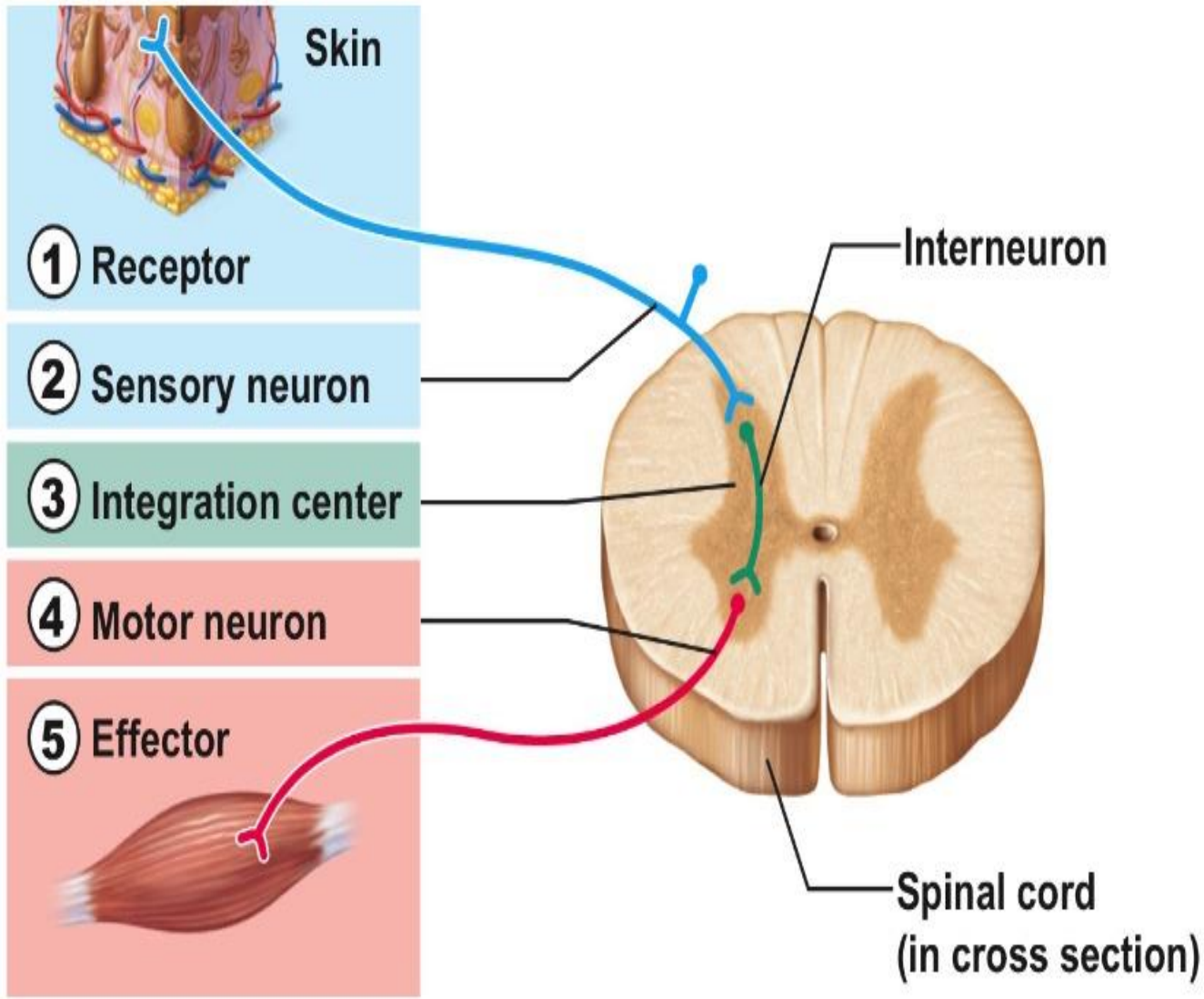
Sensory Neurons

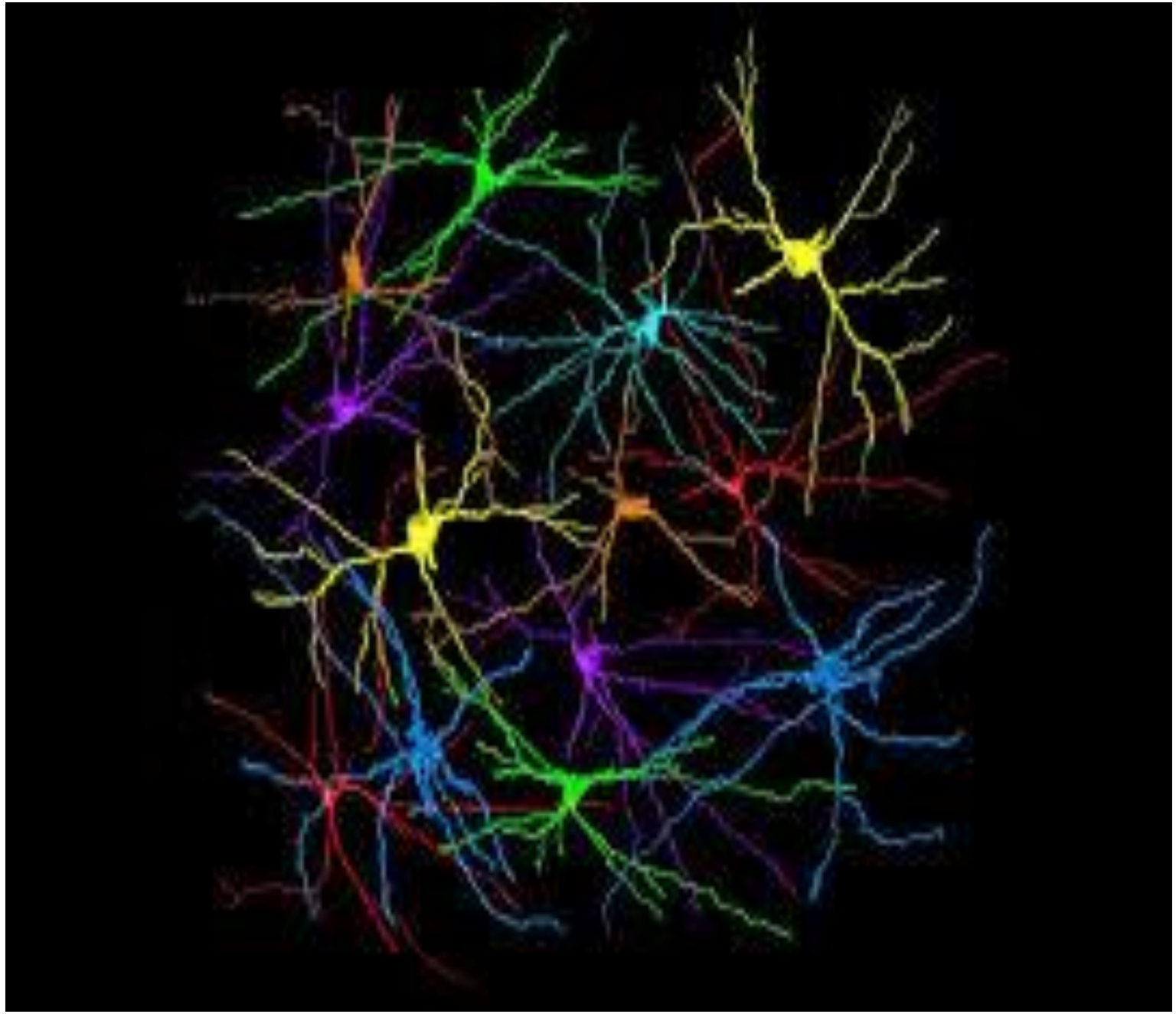


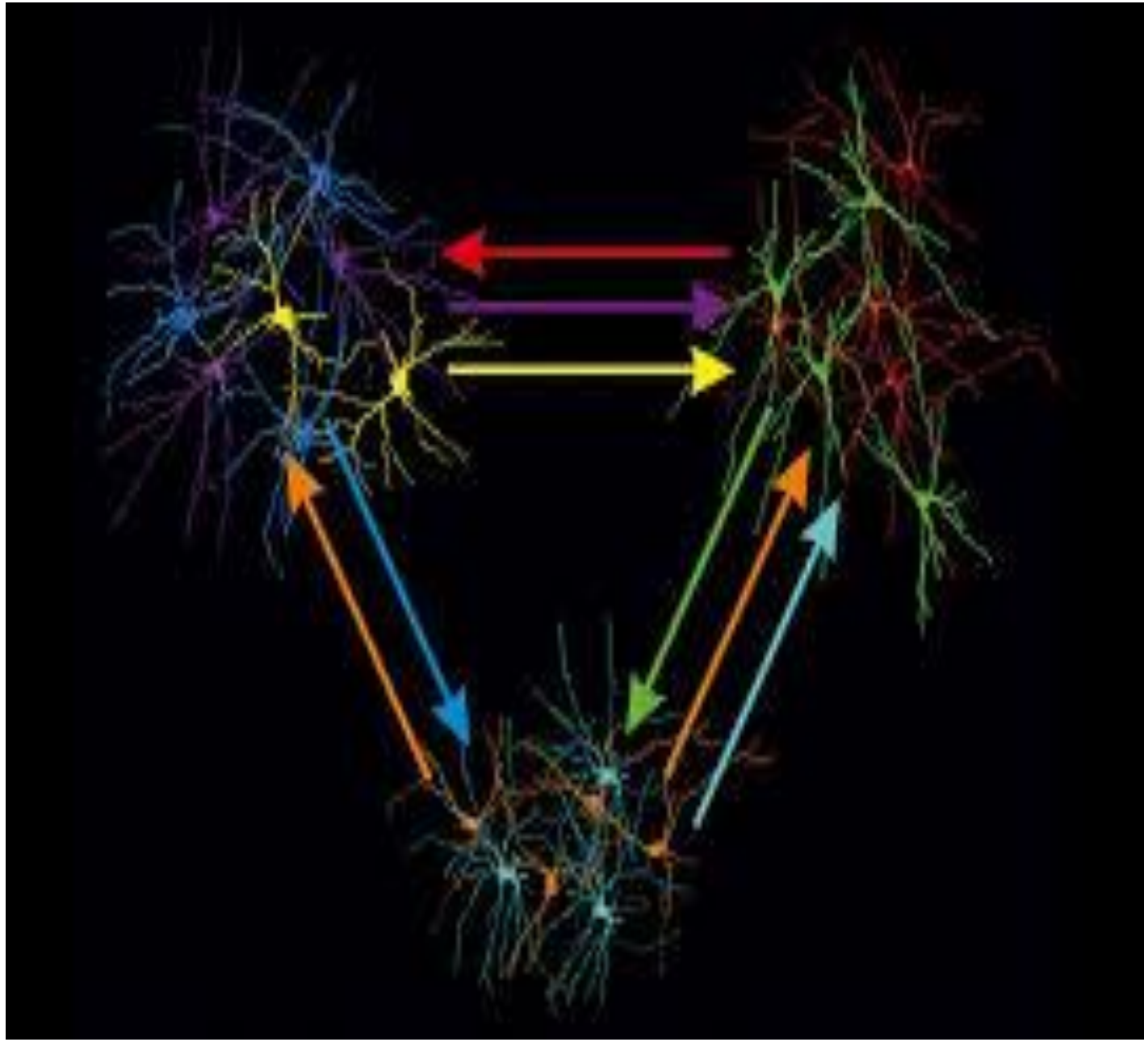
Motor Neurons



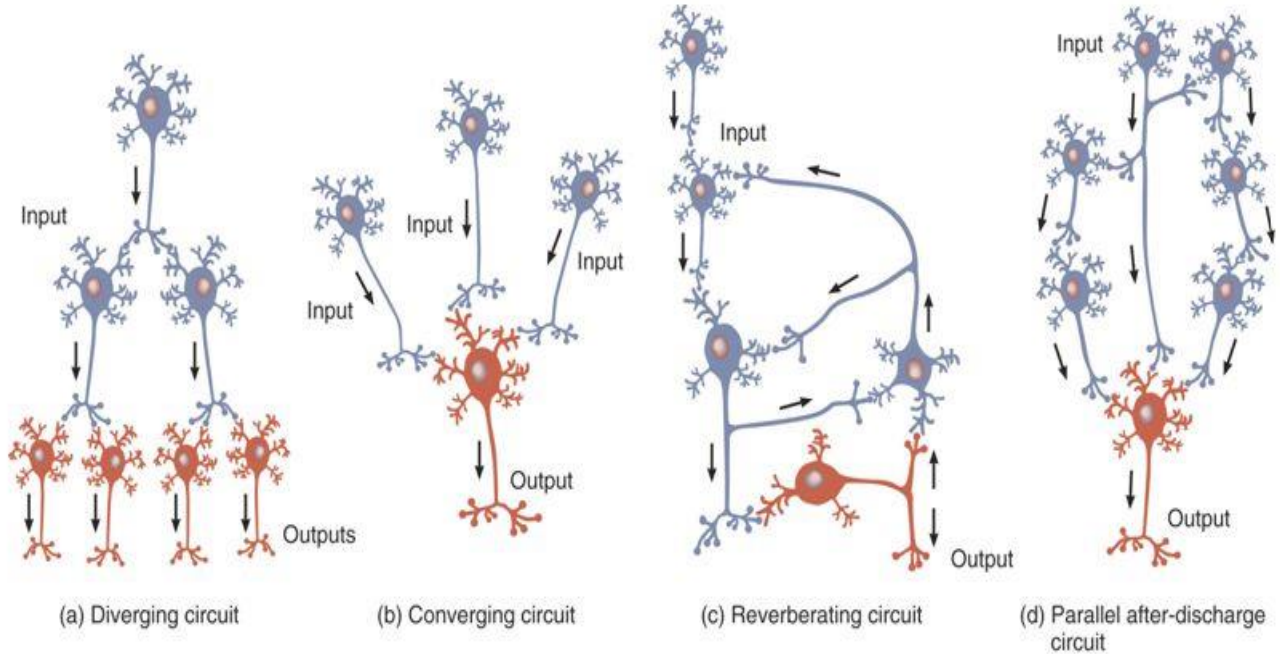
CNS Interneurons


Skin
1 Receptor
2 Sensory neuron
3 Integration center
4 Motor neuron
5 Effector
Interneuron
Spinal cord
(in cross section)





Neuronal Circuits

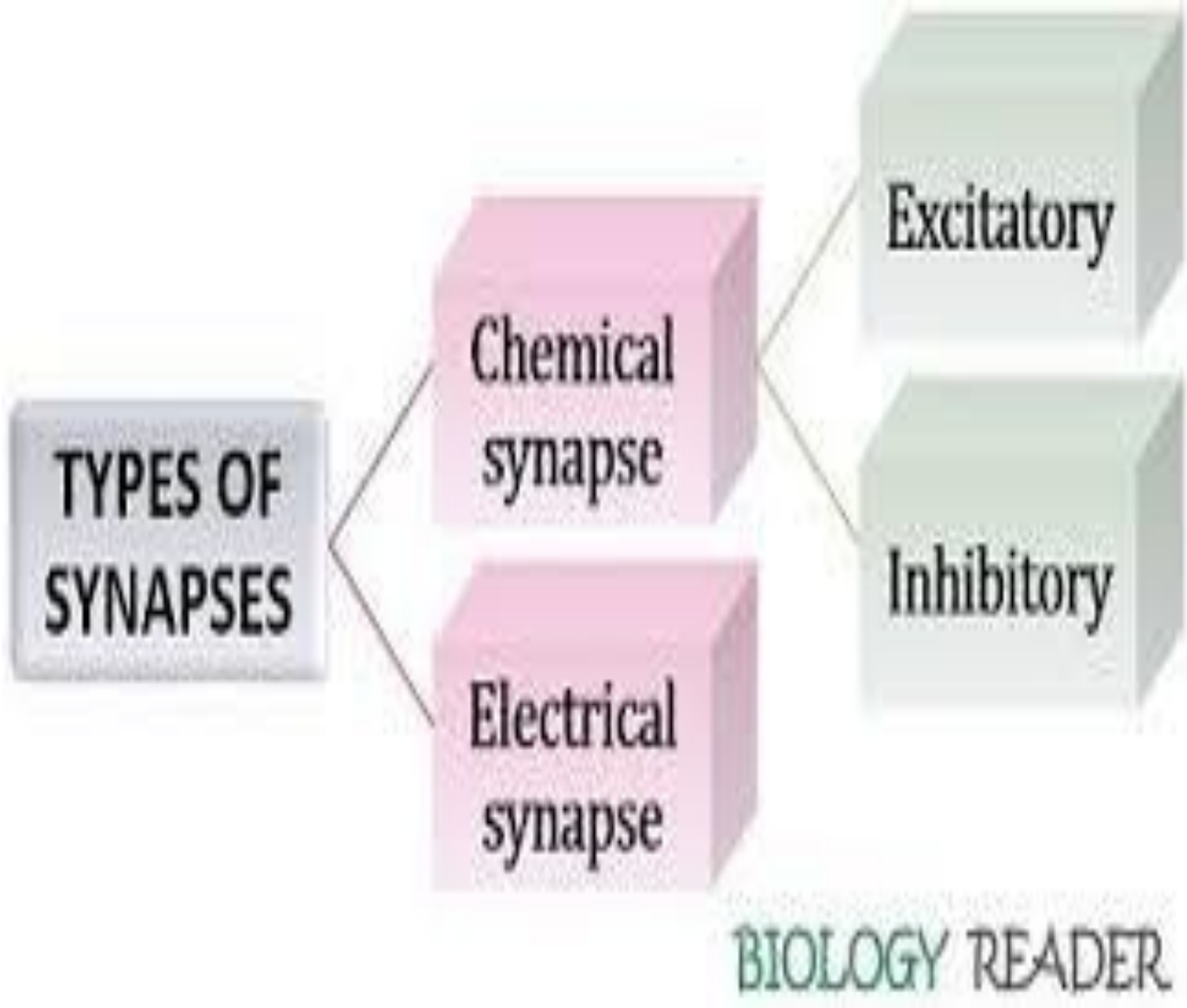


(a) Diverging circuit (b) Converging circuit (c) Reverberating circuit (d) Parallel after-discharge circuit

- Diverging -- single cell stimulates many others
- Converging -- one cell stimulated by many others
- Reverberating -- impulses from later cells repeatedly stimulate early cells in the circuit (short-term memory)
- Parallel-after-discharge -- single cell stimulates a group of cells that all stimulate a common postsynaptic cell (math problems)

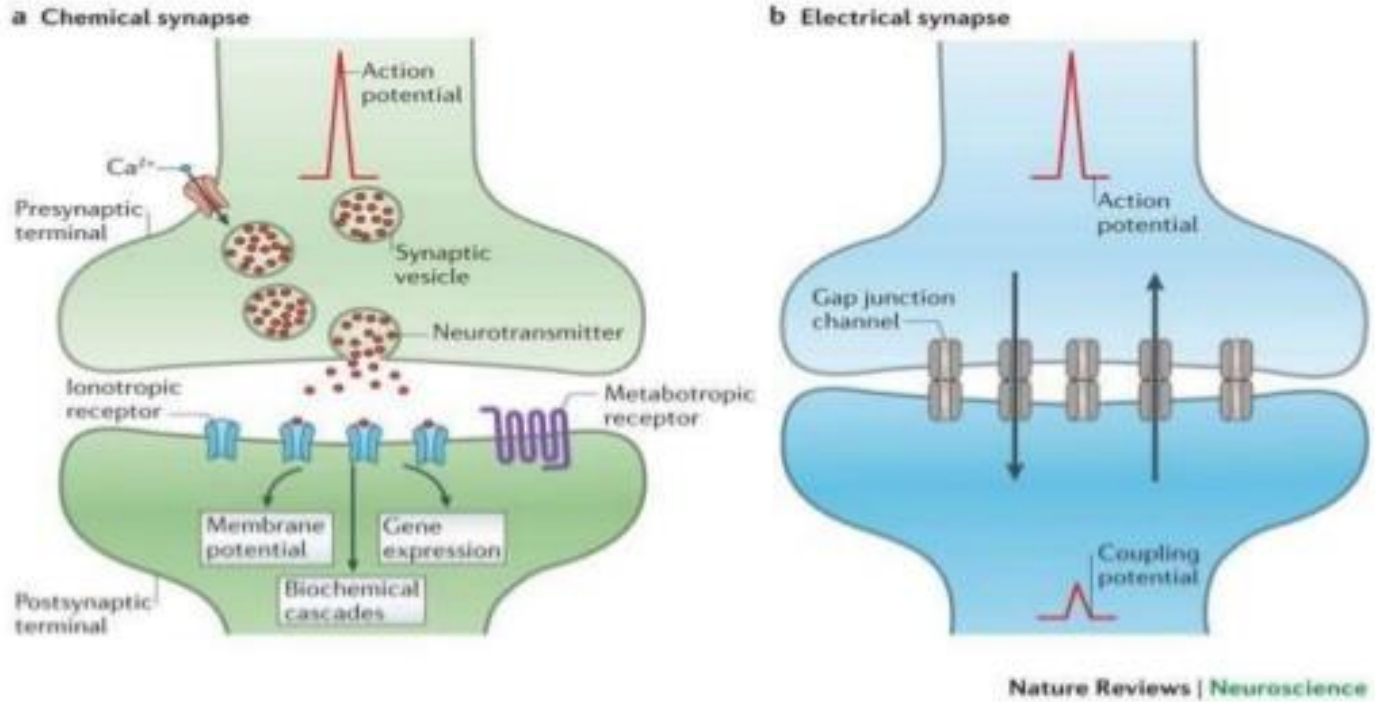
روانشناسی پزشکی و نوروپسیکولوژی، جلسه ششم

پردازش مغزی اطلاعات (قسمت دوم، نوروشیمی مغز و الکتروفیزیولوژی آن)

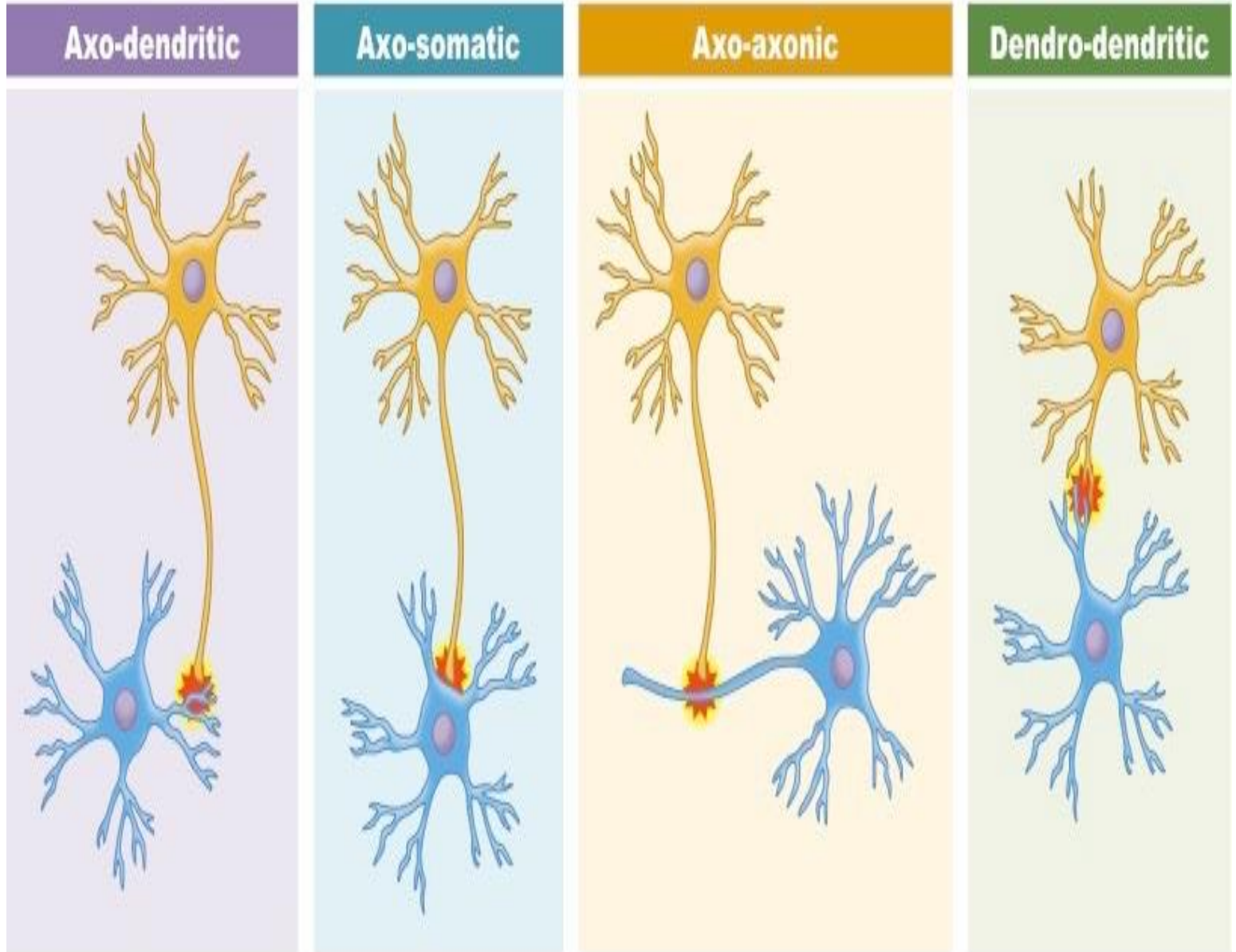

TYPES OF SYNAPSES
Chemical synapse
Electrical synapse
Excitatory
Inhibitory
BIOLOGY READER

Synapse

- **Types of synapse**
  - Electrical synapse *Vs* Chemical synapse



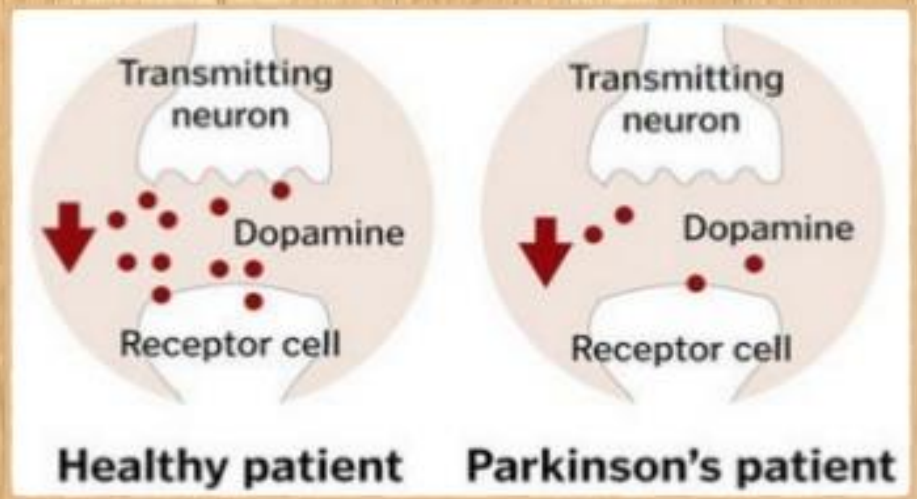
Ref: Pereda AE. Electrical synapses and their functional interactions with chemical synapses. Nature Reviews Neuroscience. 2014 ;15(4):250.


Axo-dendritic
Axo-somatic
Axo-axonic
Dendro-dendritic

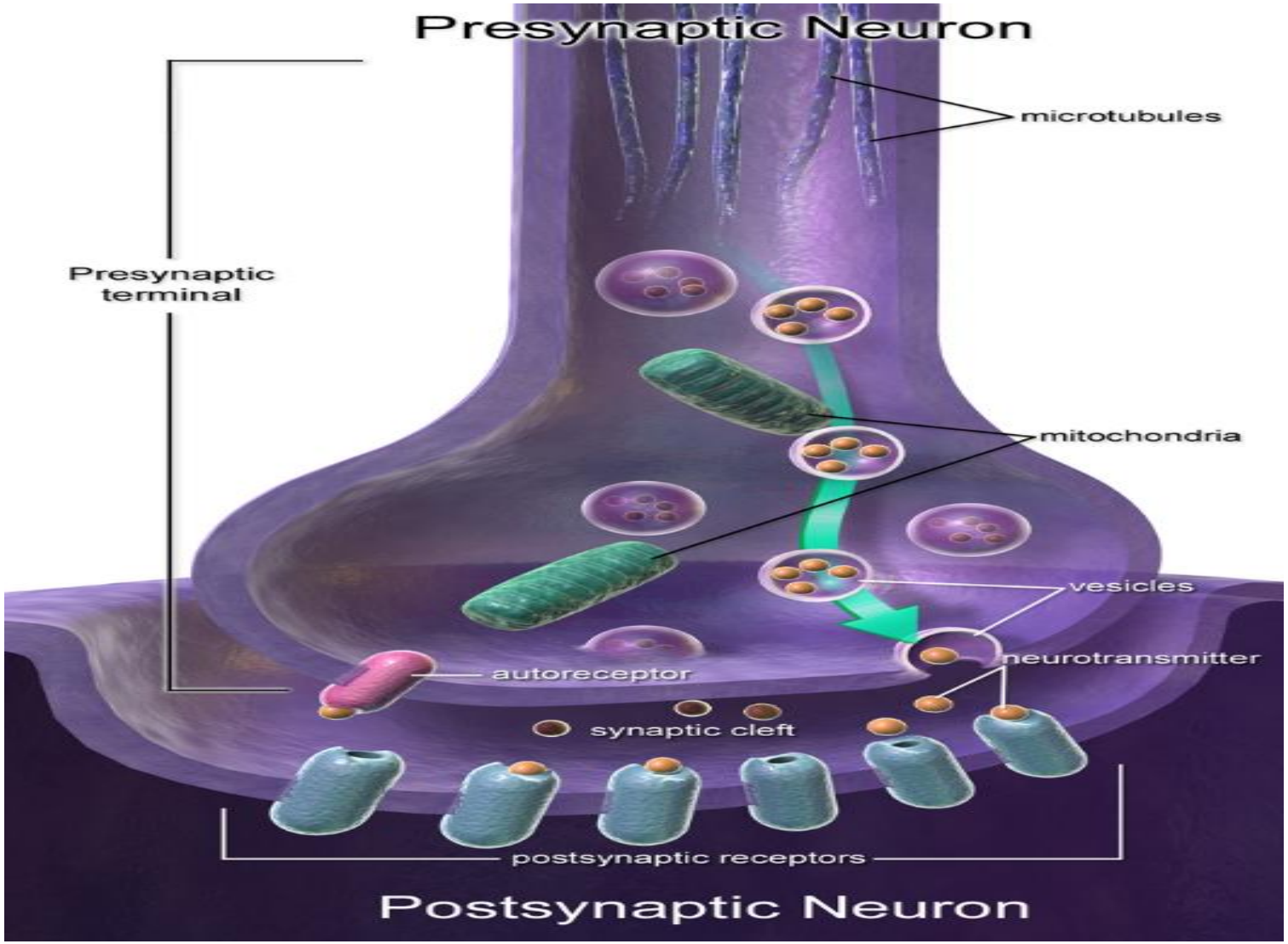
Neurotransmitters

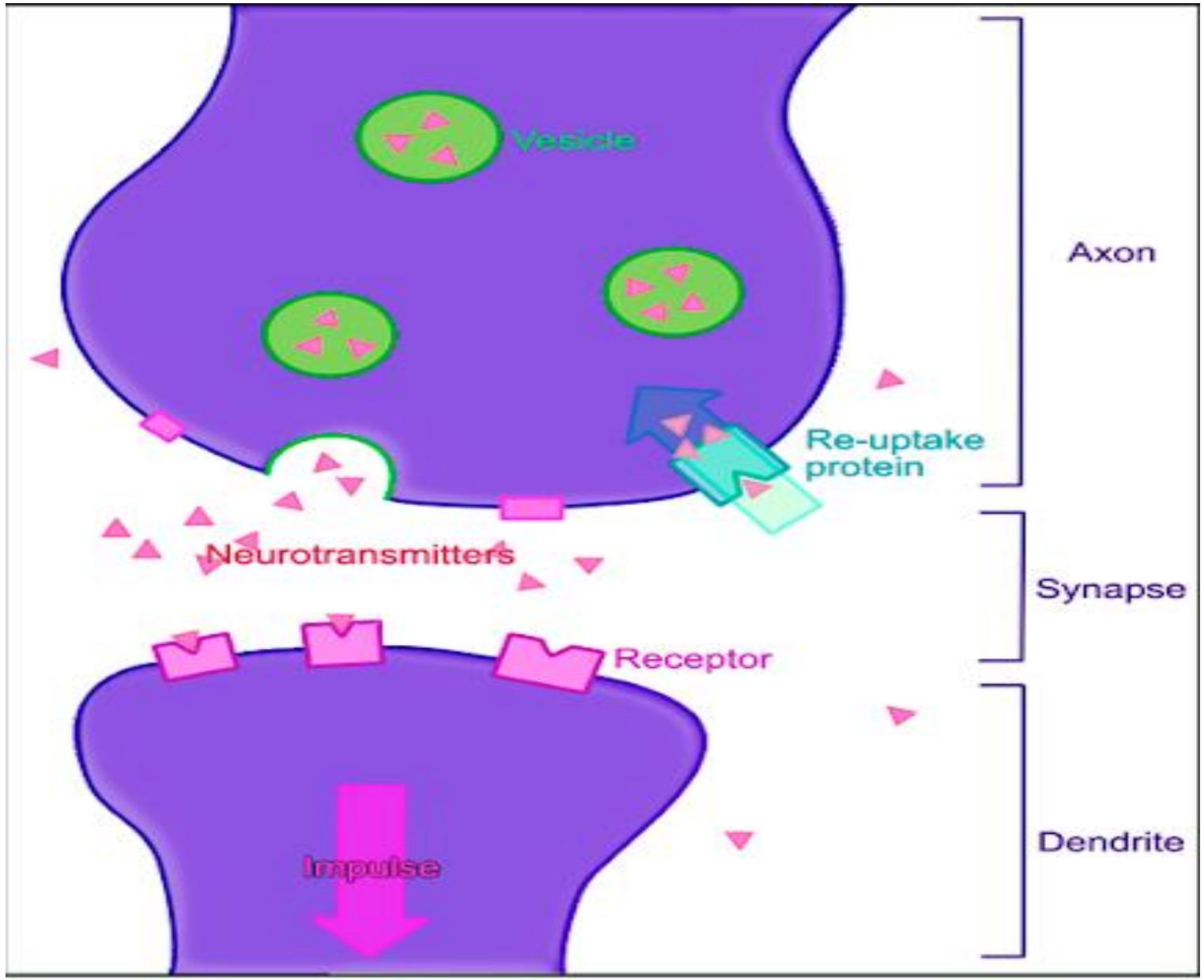
An excess or lack of neurotransmitters can impact our behavior.

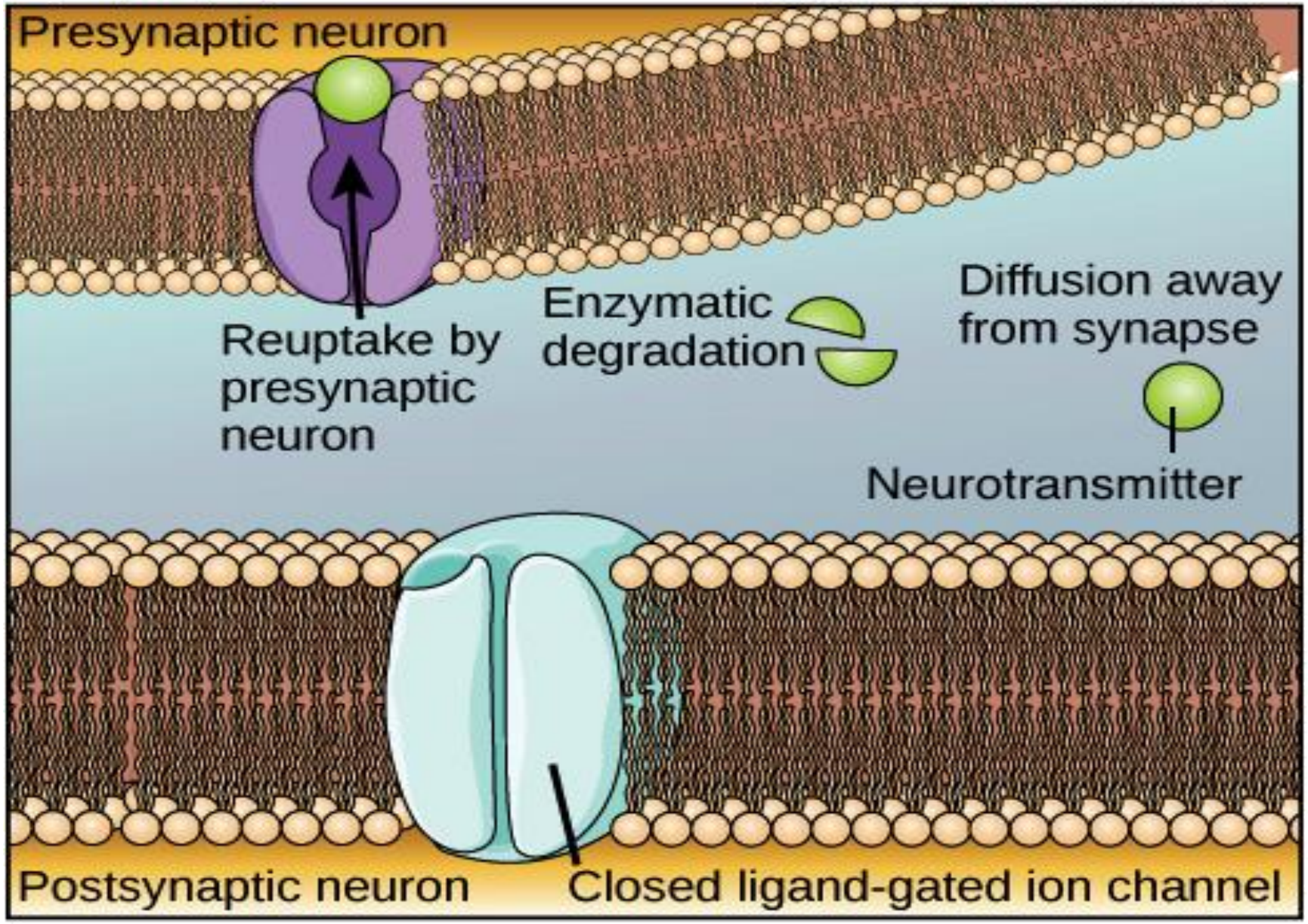
For example, Parkinson's Disease causes the brain cells that produce **dopamine** to die. The lack of dopamine in the body leads to shaking, irregular movements, and loss of motion control. Lack of dopamine also depresses your mood, which affects your personality and habits.

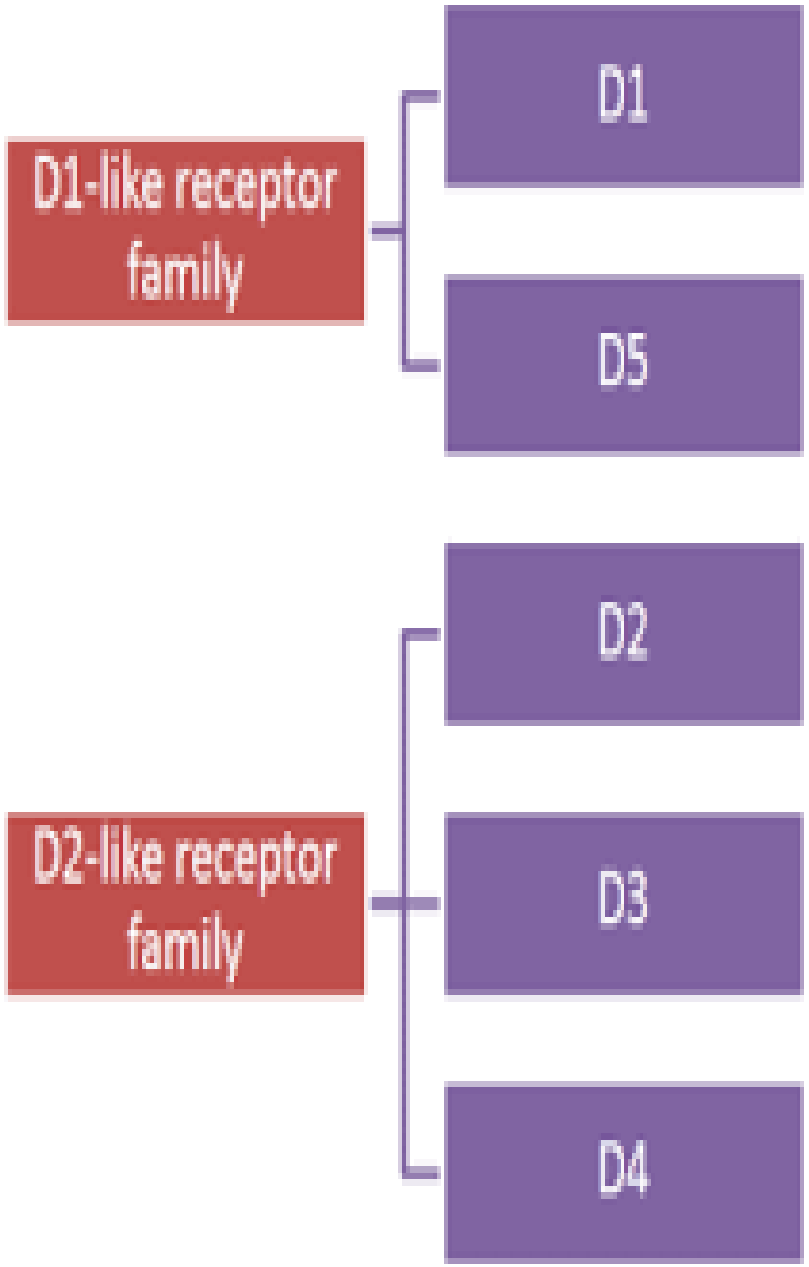



FOTOSTOCK

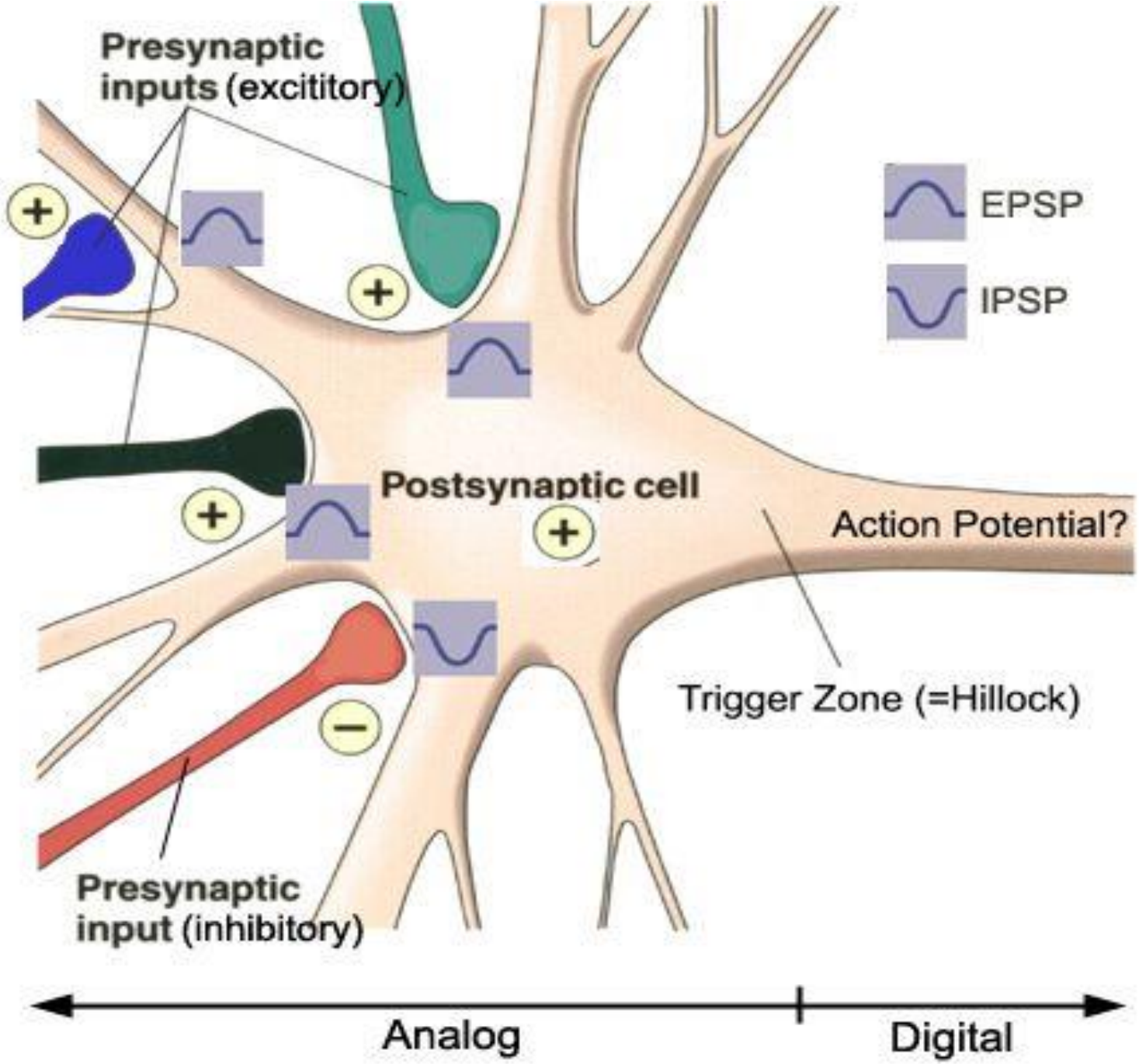

Presynaptic Neuron
microtubules
Presynaptic terminal
mitochondria
vesicles
neurotransmitter
autoreceptor
synaptic cleft
postsynaptic receptors
Postsynaptic Neuron

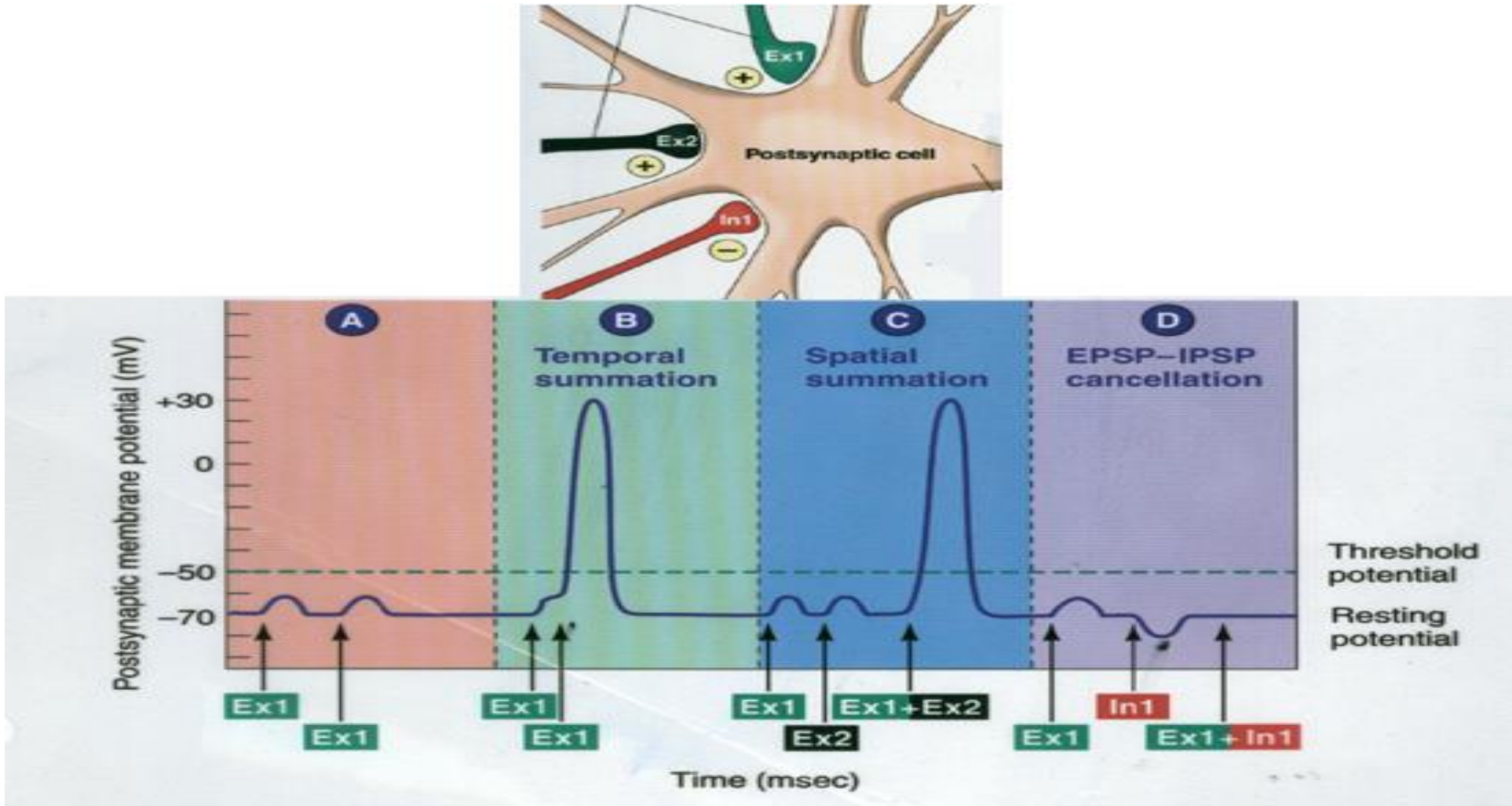

Vesicle
Axon
Re-uptake protein
Neurotransmitters
Synapse
Receptor
Impulse
Dendrite


Presynaptic neuron
Reuptake by presynaptic neuron
Enzymatic degradation
Diffusion away from synapse
Neurotransmitter
Postsynaptic neuron
Closed ligand-gated ion channel



	Location	Function
	Putamen, nucleus accumbens i.e nigrostrial pathway	Inhibition causes extrapyrimidal disorders
	Striatum, substantia nigra , pituitary	Control behaviour,voluntary, prolactin release
	Midbrain, mucleus accumbens & hypothalamus	
	Frontal cortex, medulla and midbrain i.e mesocortical pathway	
	Hypothalamus , hippocampus	


Presynaptic
inputs (excititory)
EPSP
IPSP
Postsynaptic cell
Action Potential?
Trigger Zone (=Hillock)
Presynaptic
input (inhibitory)
Analog
Digital


Ex1
Ex2
In1
Postsynaptic cell
A
B
Temporal summation
C
Spatial summation
D
EPSP–IPSP cancellation
Postsynaptic membrane potential (mV)
+30
0
–50
–70
Threshold potential
Resting potential
Ex1
Ex1
Ex1
Ex1
Ex1
Ex2
Ex1+Ex2
Ex1
In1
Ex1+In1
Time (msec)

روانشناسی پزشکی و نوروپسیکولوژی، جلسه هفتم

نوروپلاستیسیتی مغزی و اهمیت آن در رفتار و ناهنجاری های رفتاری


Neuroplasticity

neu·ro·plas·tic·i·ty

/ˌn(y)o͝orōˌplaˈstisədē/

noun

1. The brain's ability to reorganize itself by forming new neural connections throughout life… in response to new situations or to changes in [the] environment.

- Medicine.net

World Science Festival

Neuroplasticity occurs in the brain under two primary conditions:

1. During normal brain development when the immature brain first begins to process sensory information through adulthood (developmental plasticity and plasticity of learning and memory).

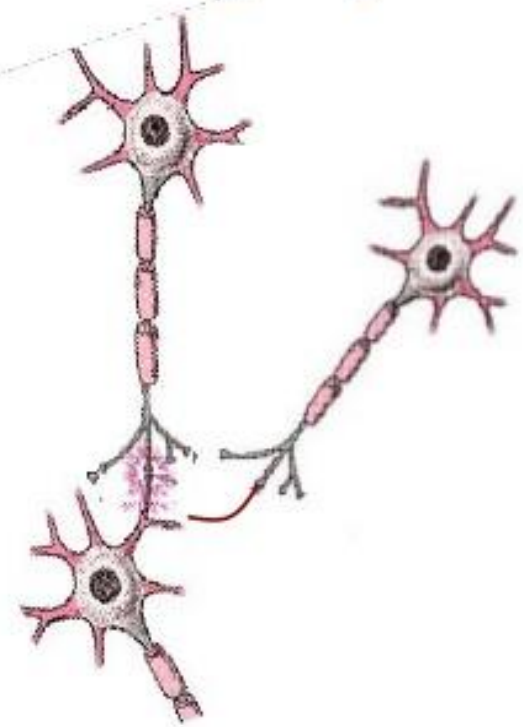
2. As an adaptive mechanism to compensate for lost function and to maximize remaining functions in damaged brain.

2 Types of Plasticity

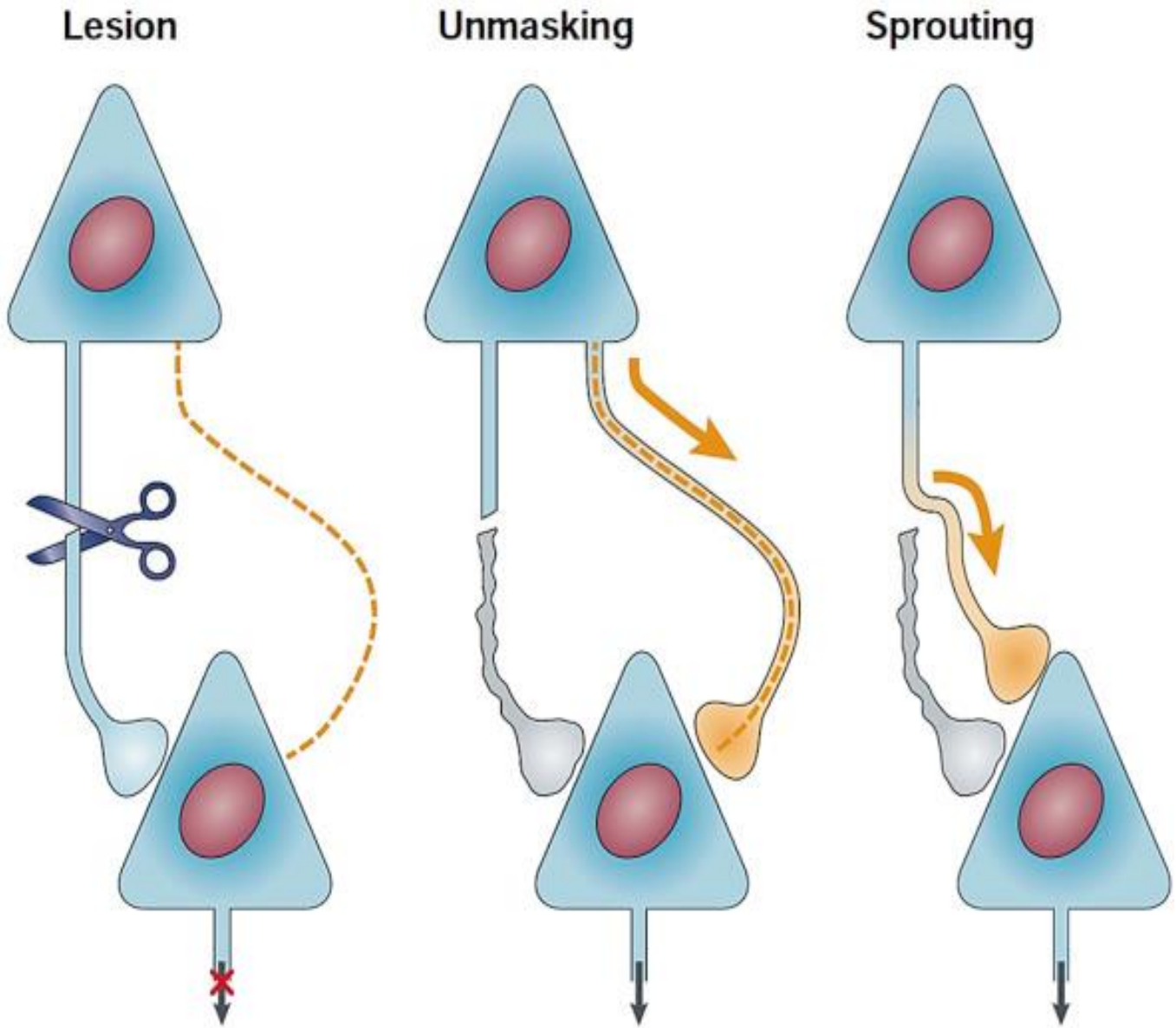
1. Structural Plasticity – Actual changing of the neuron or actually growing new neurons.
   - Neurogenesis only occurs in the hippocampus
2. Functional Plasticity – When an area of the brain takes up a new function to replace a damaged area of the brain.

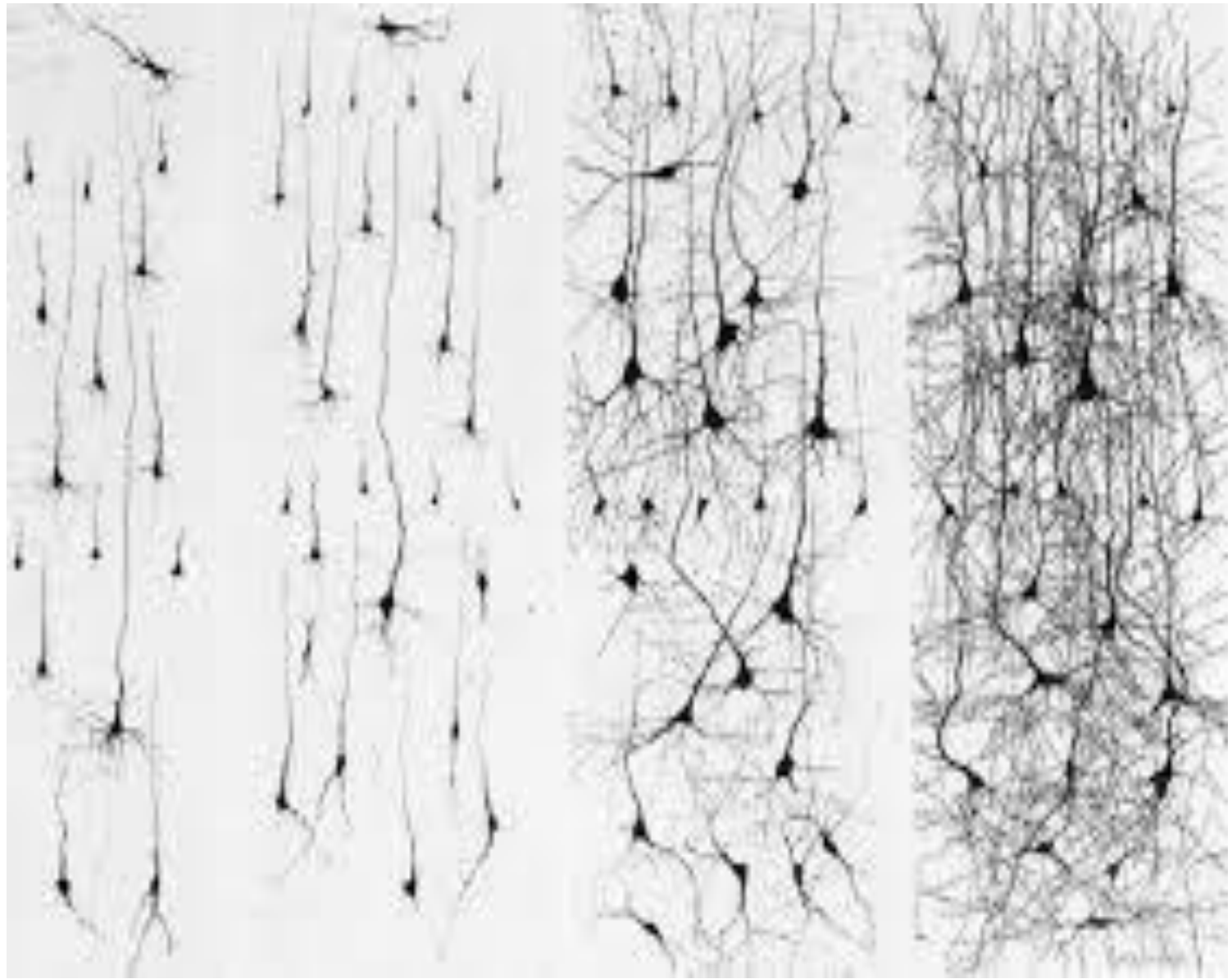
Mechanism of Neuroplasticity in CNS after an injury

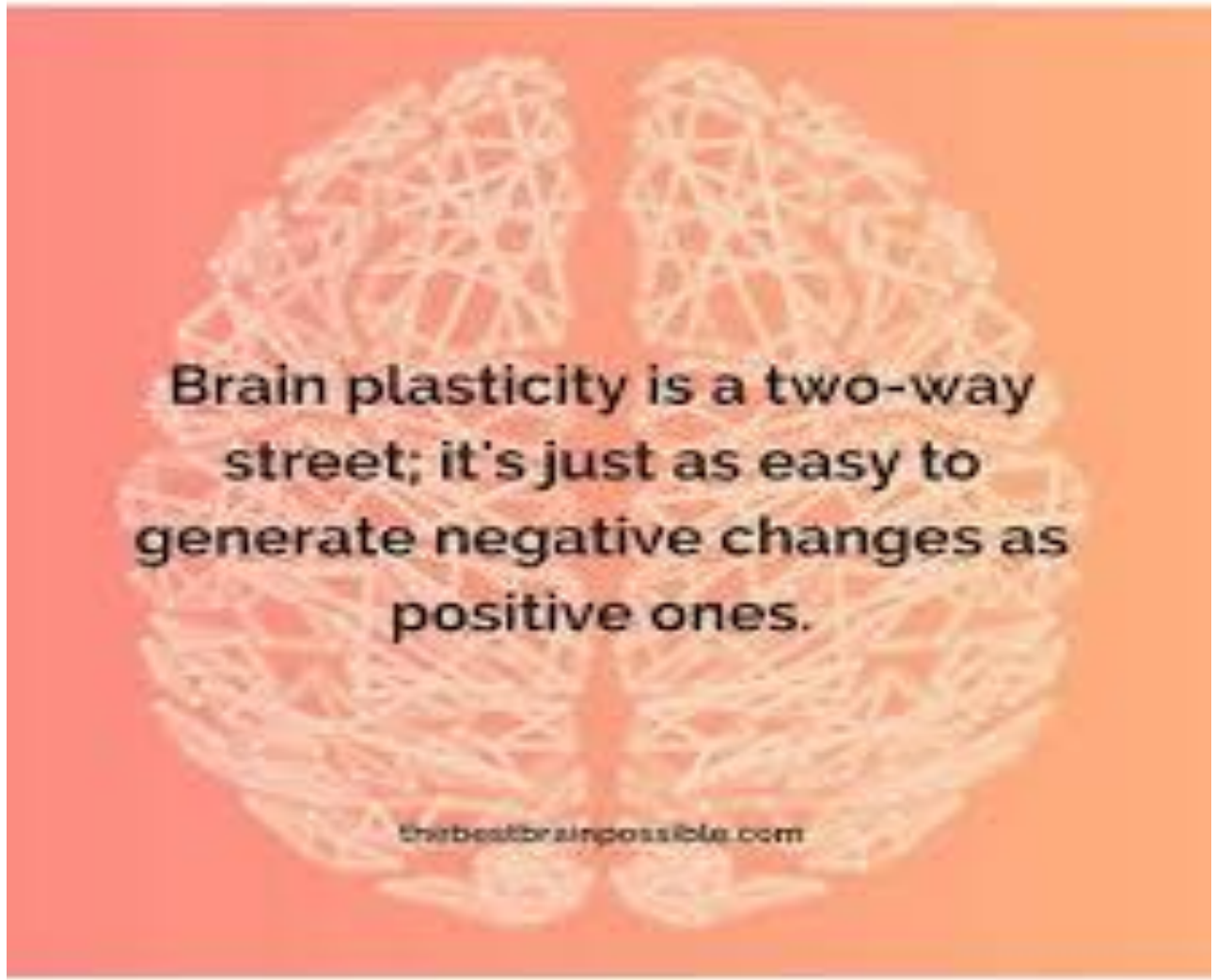
- Acute reorganization
  - Unmasking of previously present lat synapses.
- Chronic reorganization
  - Changes in synaptic efficacy.
  - Growth of new synapses by axonal sprouting.



These plasticity changes in CNS can occur at multiple levels like cerebral cortex, brain stem and spinal cord.


Lesion
Unmasking
Sprouting




Brain plasticity is a two-way street; it's just as easy to generate negative changes as positive ones.
thebestbrainpossible.com

روانشناسی پزشکی و نوروپسیکولوژی، جلسه هشتم

دگرگونی های مغزی مرتبط با ناهنجاری های رفتاری (قسمت اول)

روانشناسی پزشکی و نوروپسیکولوژی، جلسه نهم

دگرگونی های مغزی مرتبط با ناهنجاری های رفتاری (قسمت دوم)

روانشناسی پزشکی و نوروپسیکولوژی، جلسه دهم

نوروفیزیولوژی ادراک و اهمیت نواحی قشری ارتباطی

Basic Definitions

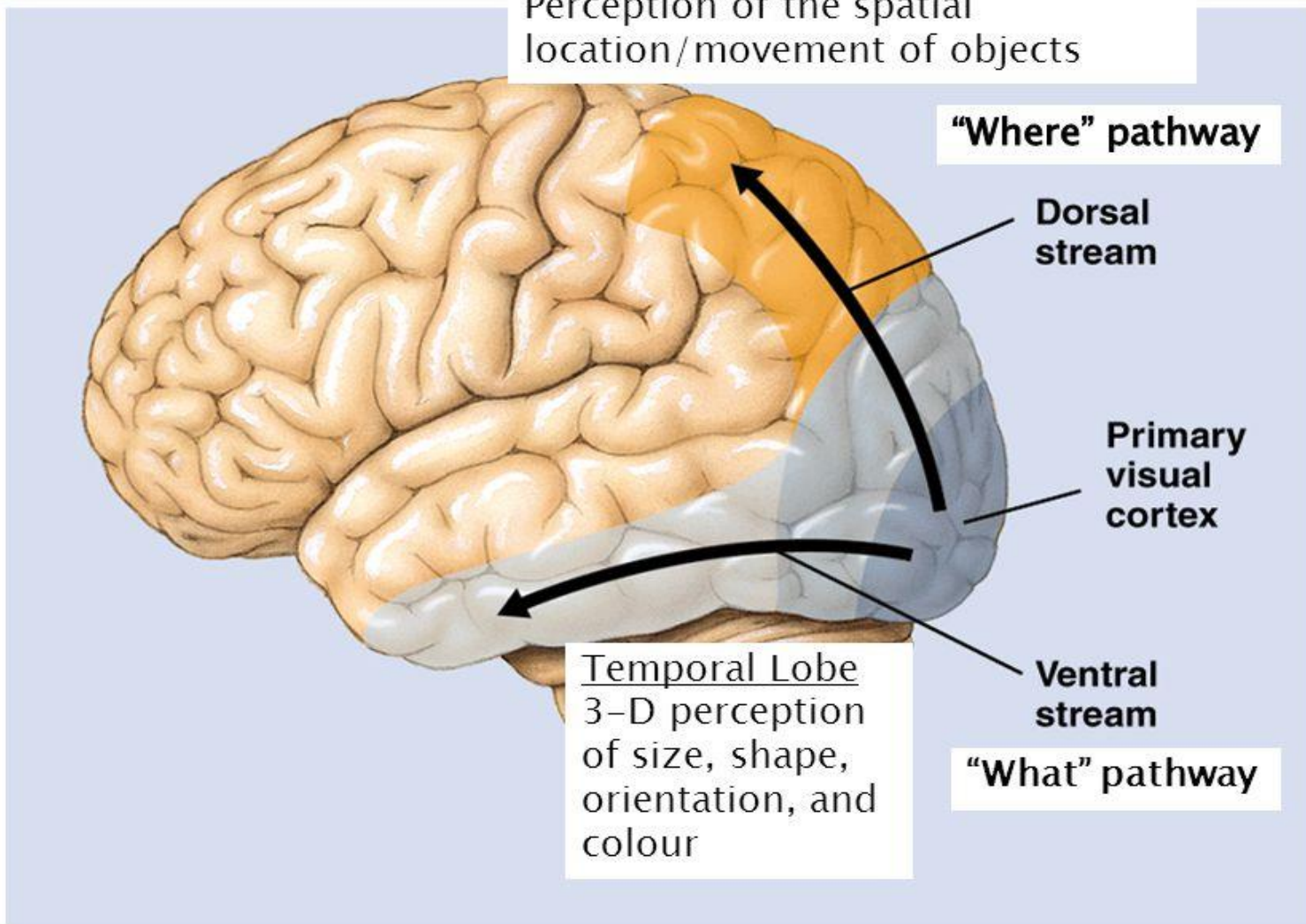
- *Sensation*—the act of using our sensory systems to detect environmental stimuli
- *Perception*—recognizing and identifying sensory stimulus

Raw Sensory Data	
Vision	Light waves
Hearing	Sound waves
Smell	Airborne chemicals
Taste	Food chemicals
Touch	Pressure

Sensation and Perception

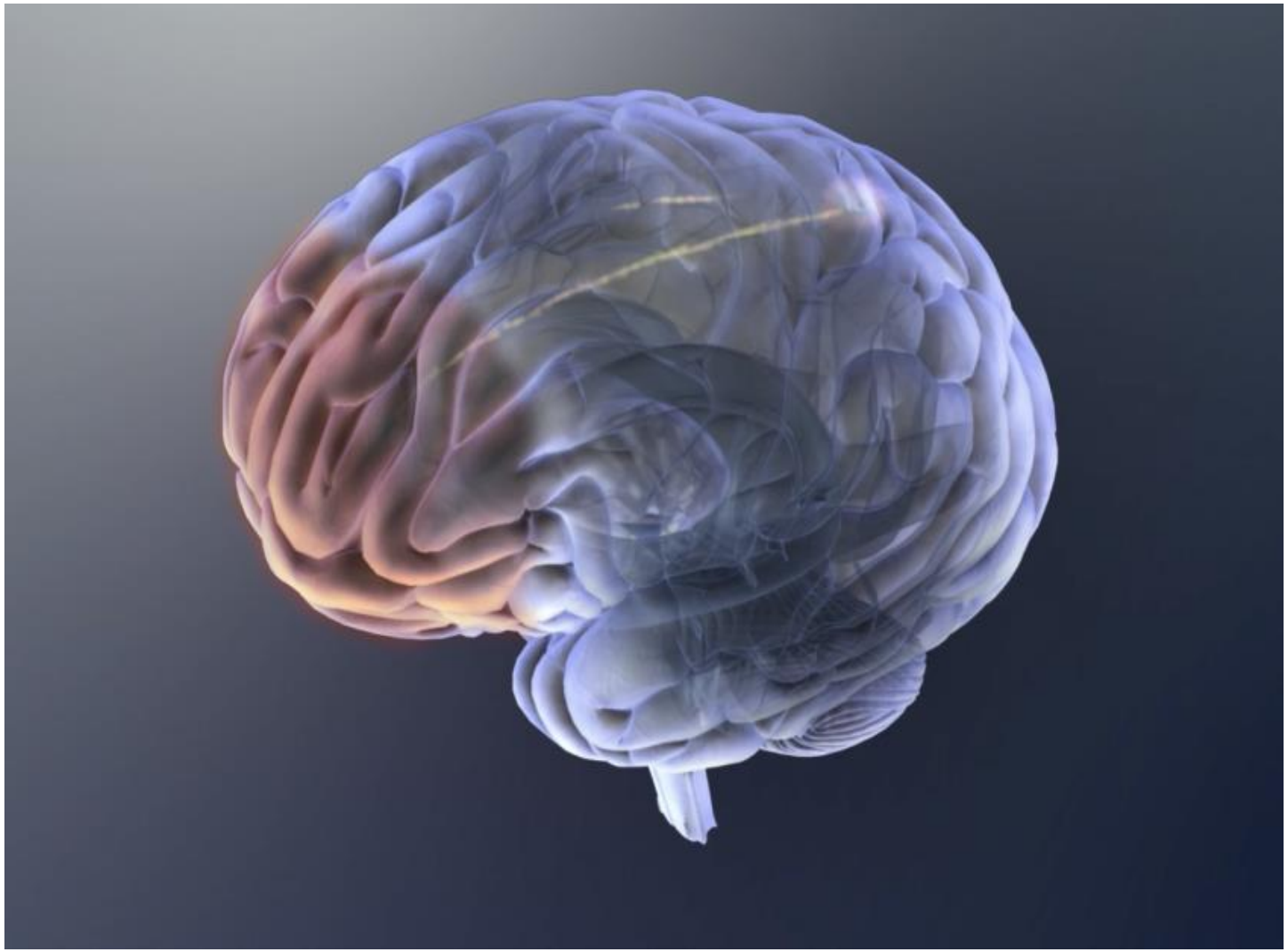
- Perception – the process of selecting,
- organizing and
- interpreting raw sensory data into useful mental representations of the world

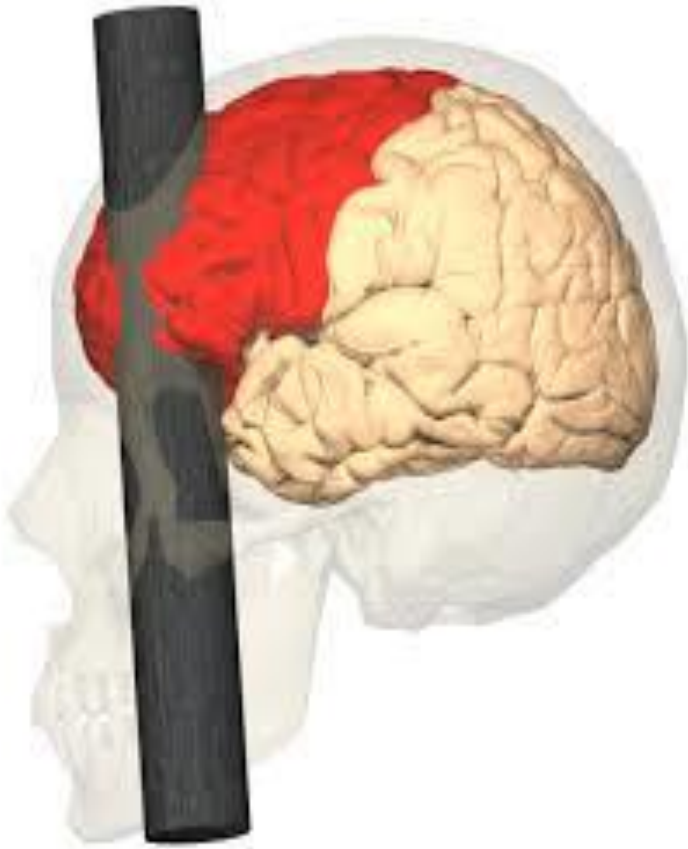
► **Visual Information Pathways**



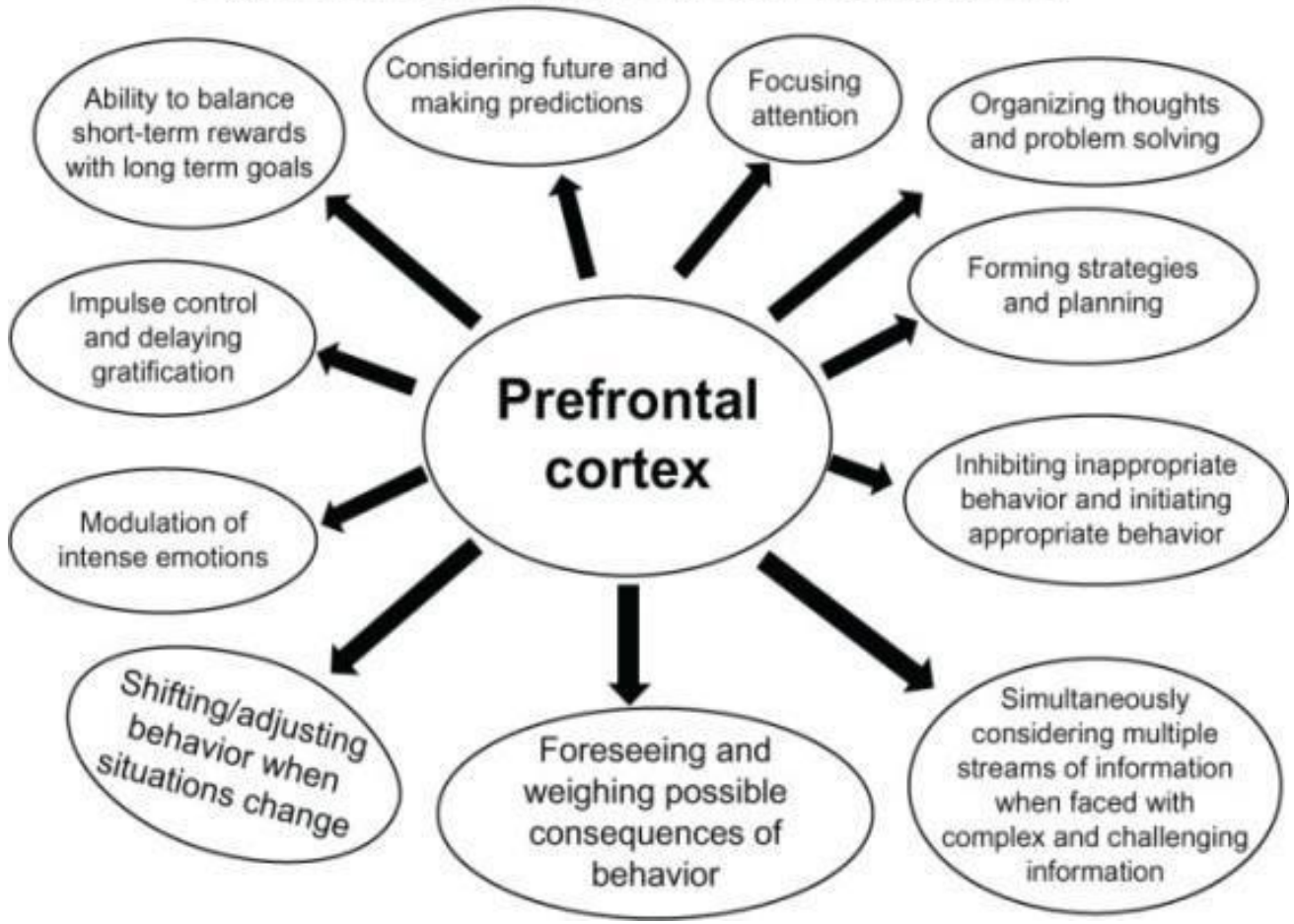
روانشناسی پزشکی و نوروپسیکولوژی، جلسه یازدهم

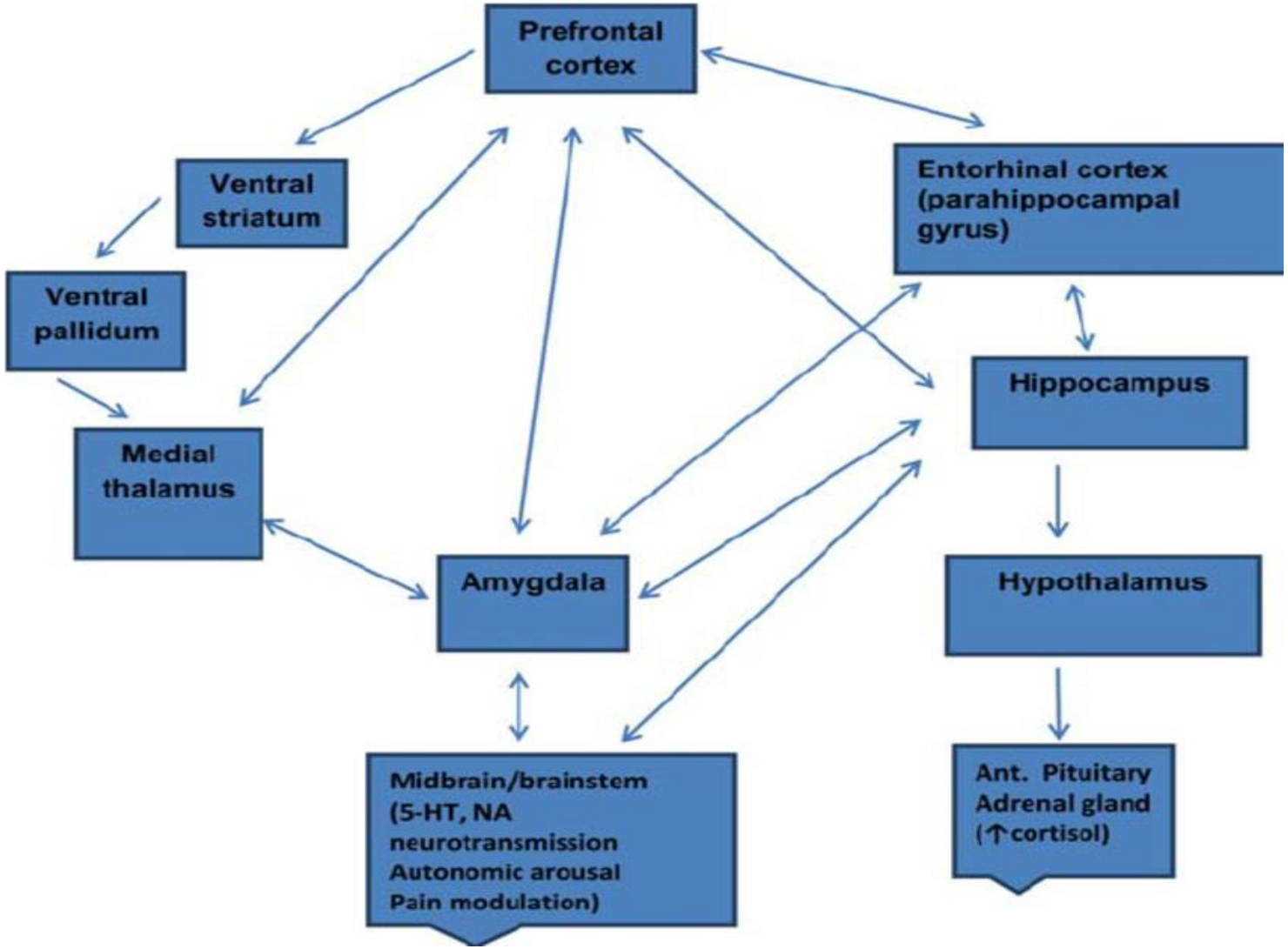
نقش قشر پیشانی مغز در فرایندهای عالی ذهنی
و اختلالات رفتاری ناشی از آسیب آن

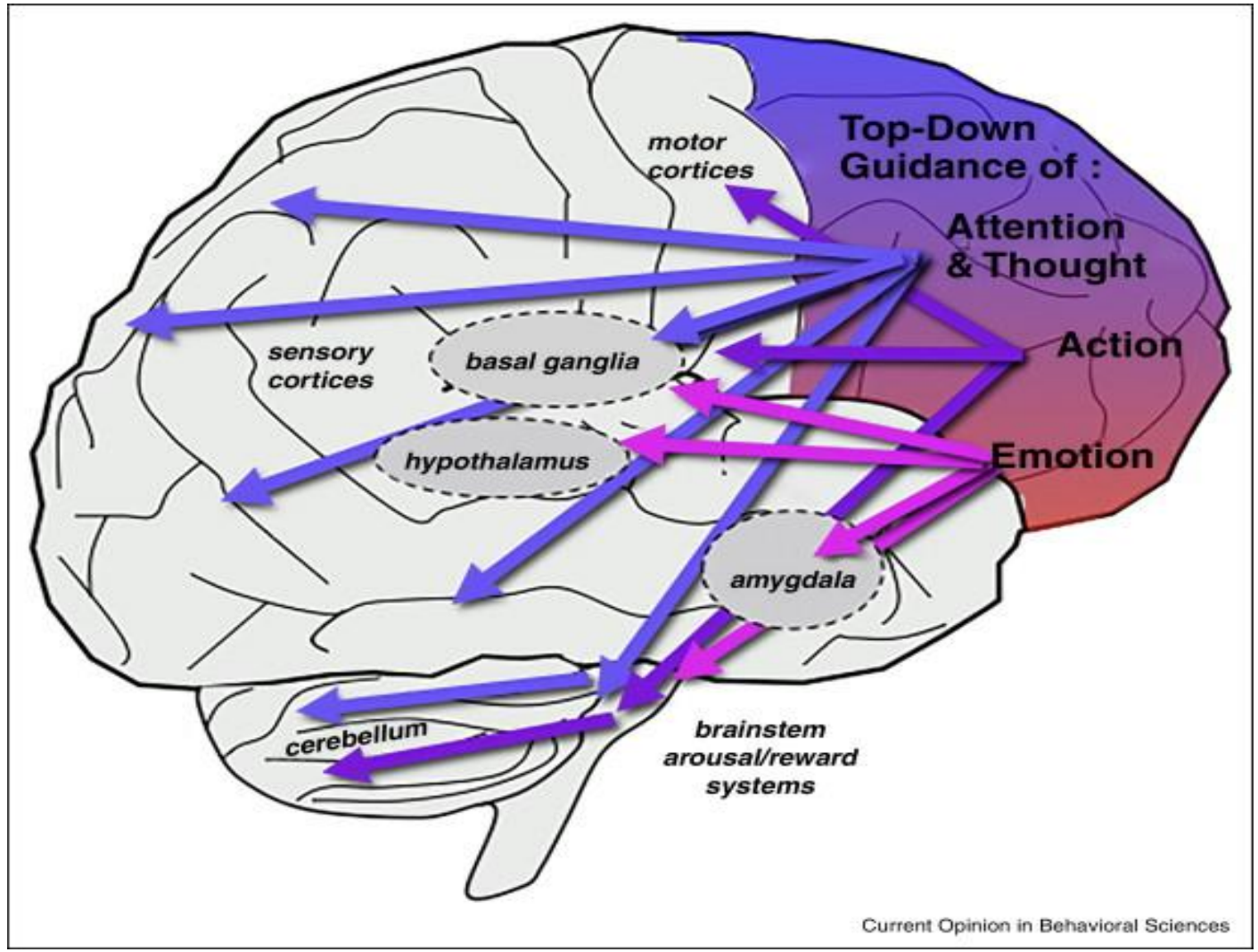


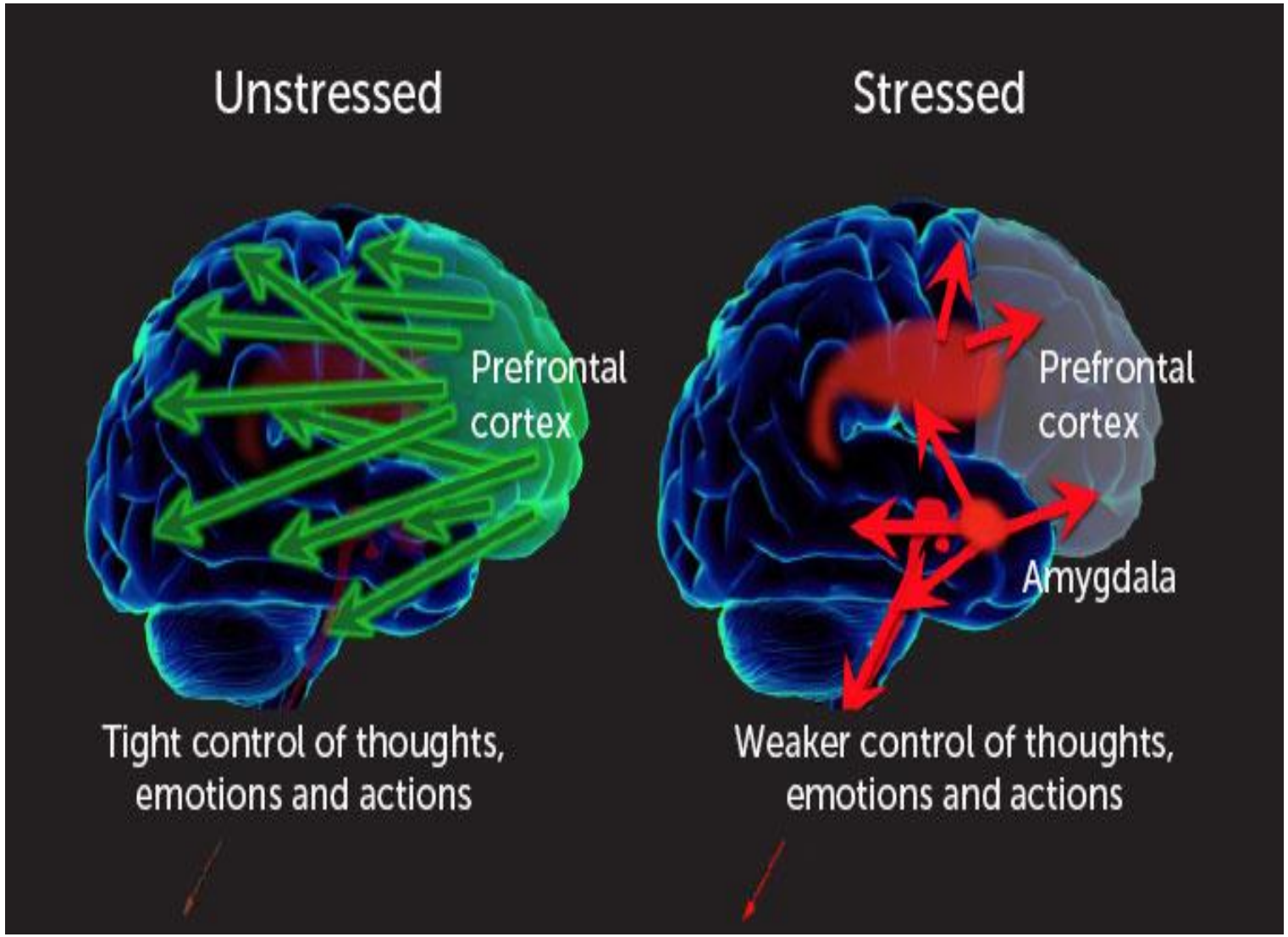


Executive human brain functions



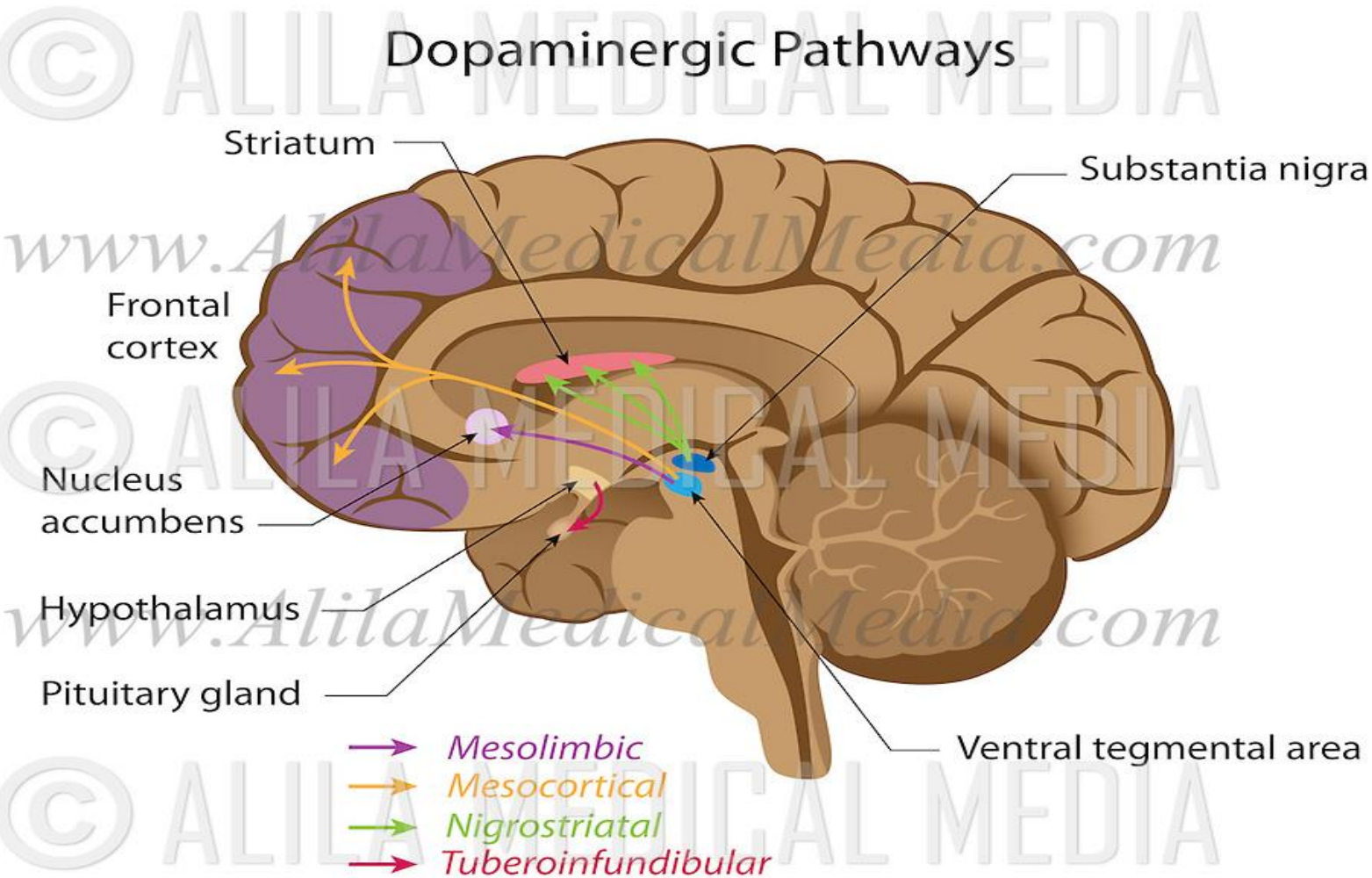

Prefrontal cortex
Ventral striatum
Ventral pallidum
Medial thalamus
Entorhinal cortex (parahippocampal gyrus)
Hippocampus
Amygdala
Hypothalamus
Midbrain/brainstem (5-HT, NA neurotransmission Autonomic arousal Pain modulation)
Ant. Pituitary Adrenal gland (↑cortisol)


Top-Down
Guidance of :
Attention
& Thought
Action
Emotion
motor
cortices
sensory
cortices
basal ganglia
hypothalamus
amygdala
cerebellum
brainstem
arousal/reward
systems
Current Opinion in Behavioral Sciences


Unstressed
Stressed
Prefrontal cortex
Prefrontal cortex
Amygdala
Tight control of thoughts, emotions and actions
Weaker control of thoughts, emotions and actions

روانشناسی پزشکی و نوروپسیکولوژی، جلسه دوازدهم

سیستم های مغزی دوپامینرژیک، نورآدرنرژیک و سروتونینرژیک



Positive Symptoms

- Hallucinations
- Delusions

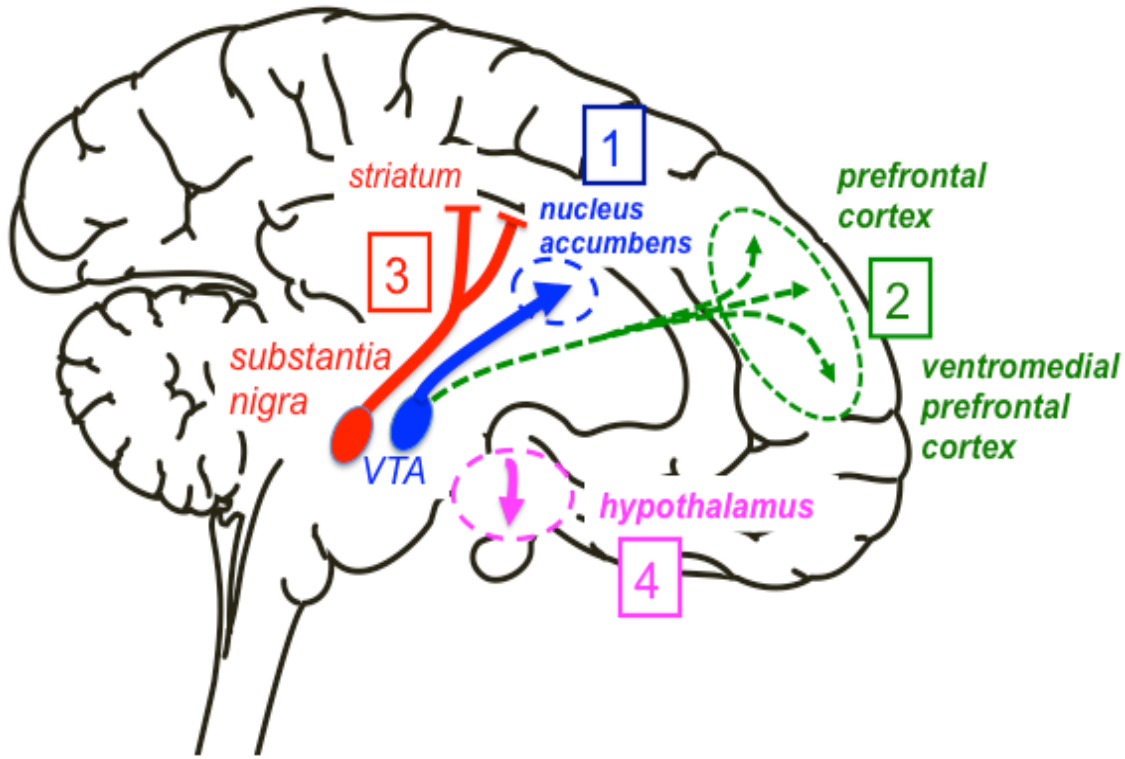
Negative Symptoms

- Anhedonia
- Amotivation
- Social Withdrawal
- Flat affect

Cognitive Symptoms

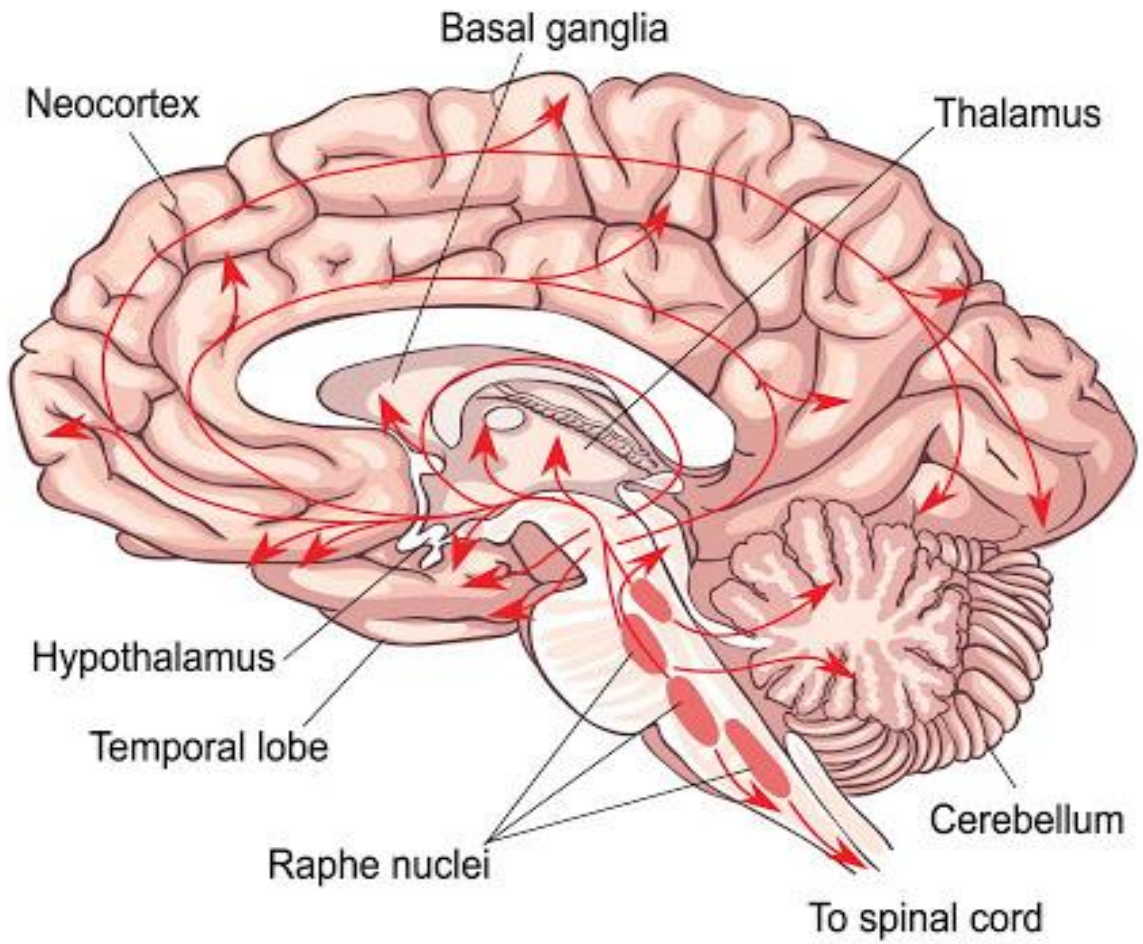
- Poor short/long-term memory
- Speech/Communication Difficulties
- Inattention

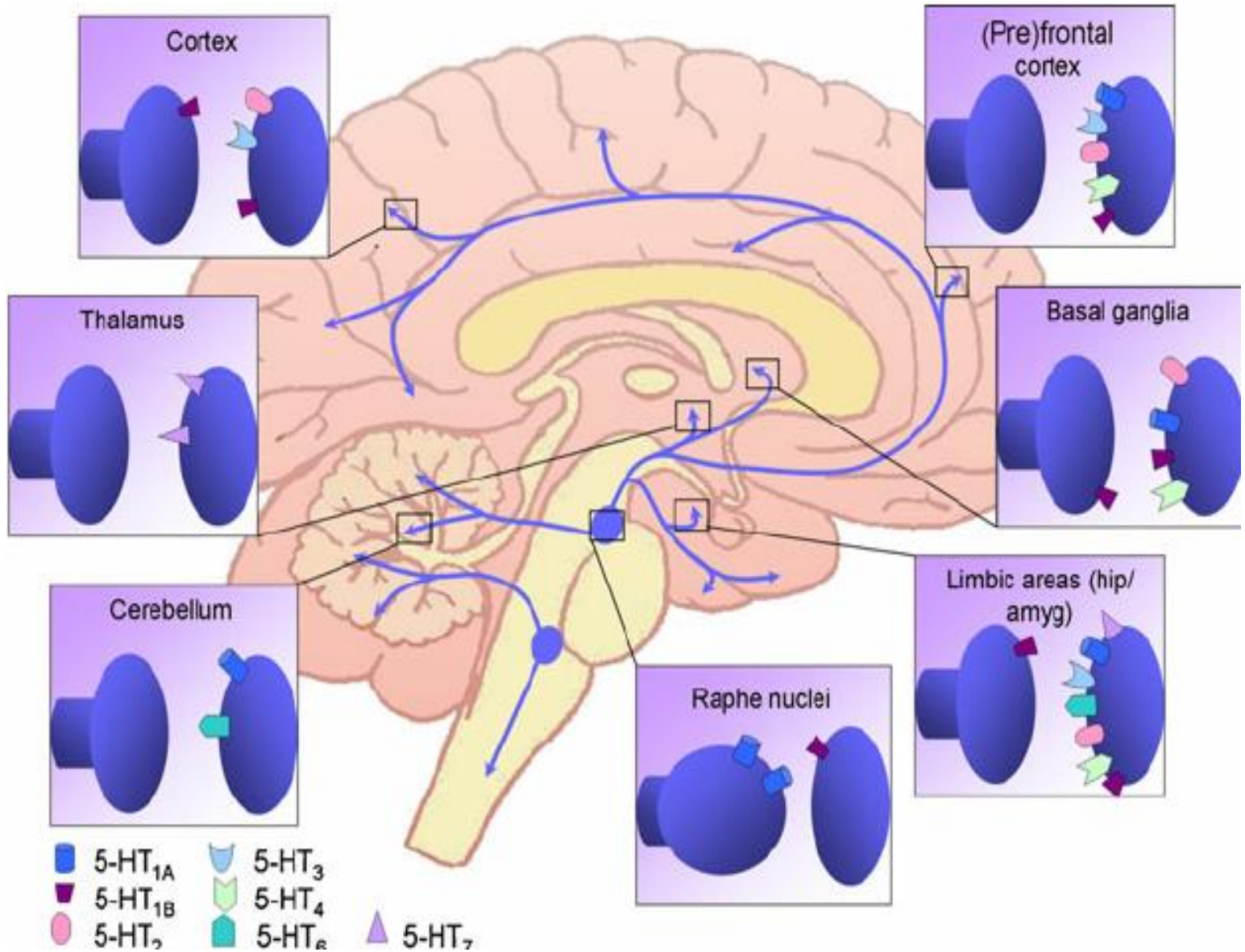
Four Dopamine Pathways & Schizophrenia

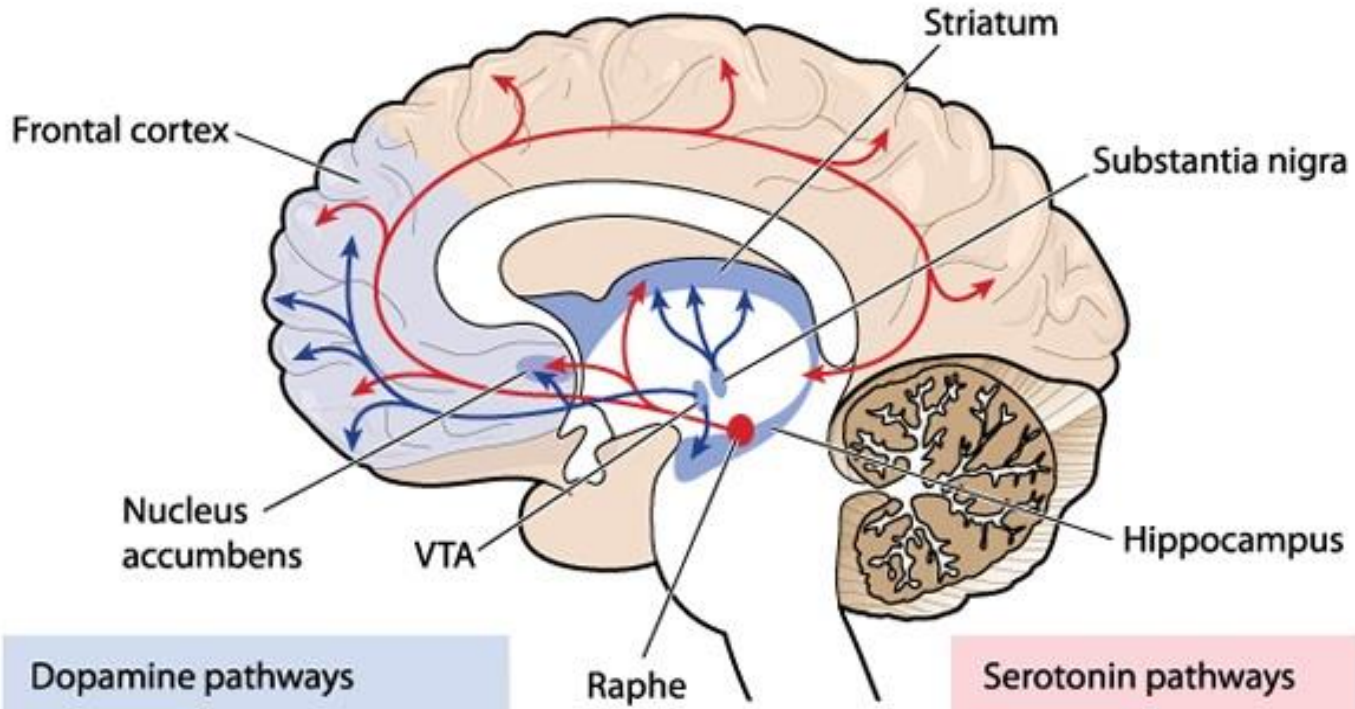


1) Mesolimbic (SCZ - increase in DA causes positive symptoms)
2) Mesocortical (SCZ – *DA hypoactivity*: negative & cognitive & affective symptoms)
3) Nigrostriatal (Drugs - EPS & TD drug side effects)
4) Tuberohypophyseal (Drugs - hyperprolactinemia side effects)

SEROTONIN SYSTEM




Cortex
(Pre)frontal cortex
Thalamus
Basal ganglia
Cerebellum
Limbic areas (hip/ amyg)
Raphe nuclei
5-HT1A
5-HT1B
5-HT2
5-HT3
5-HT4
5-HT6
5-HT7



Dopamine pathways

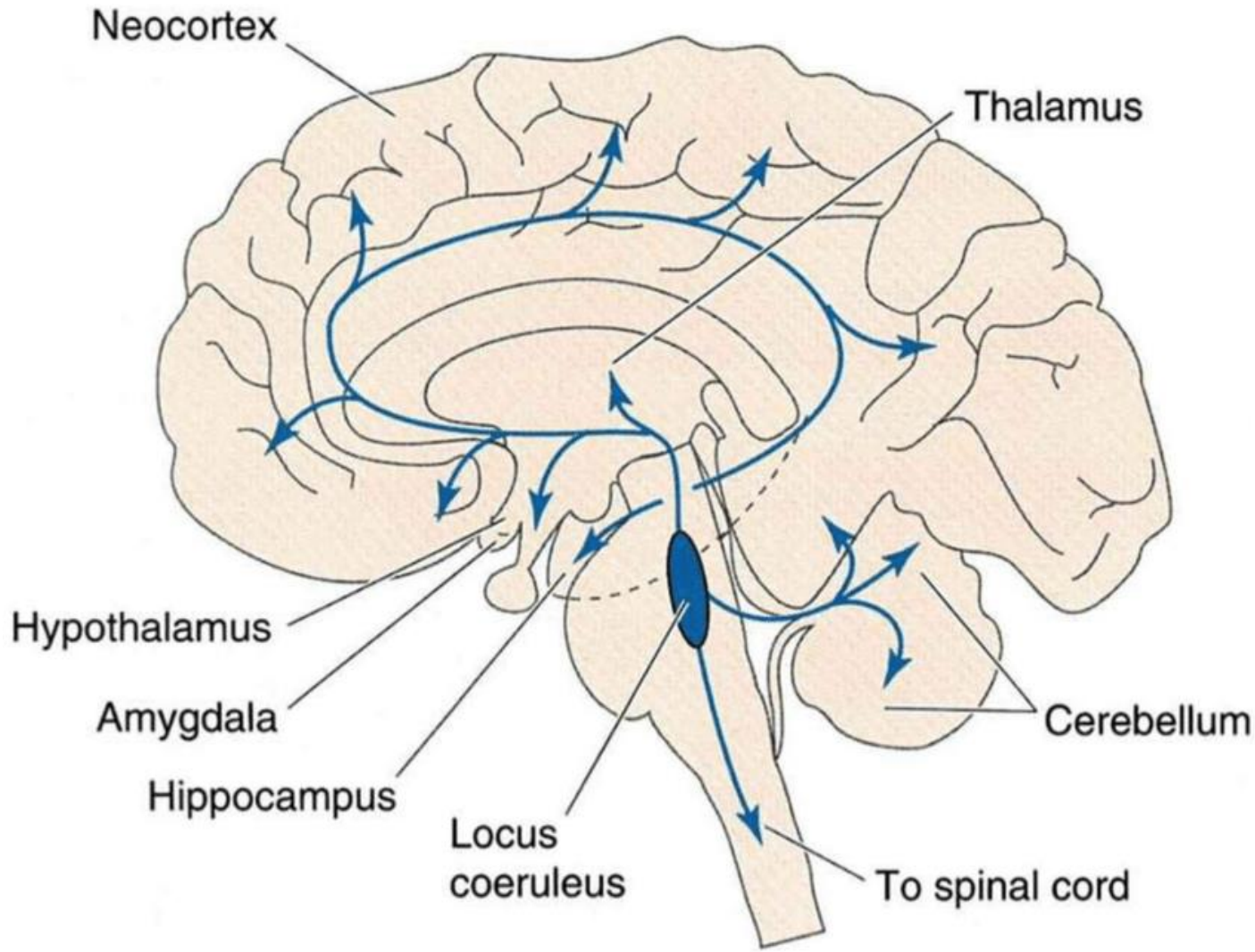
Functions

- Reward (motivation)
- Pleasure, euphoria
- Motor function (fine tuning)
- Compulsion
- Perseveration

Serotonin pathways

Functions

- Mood
- Memory processing
- Sleep
- Cognition

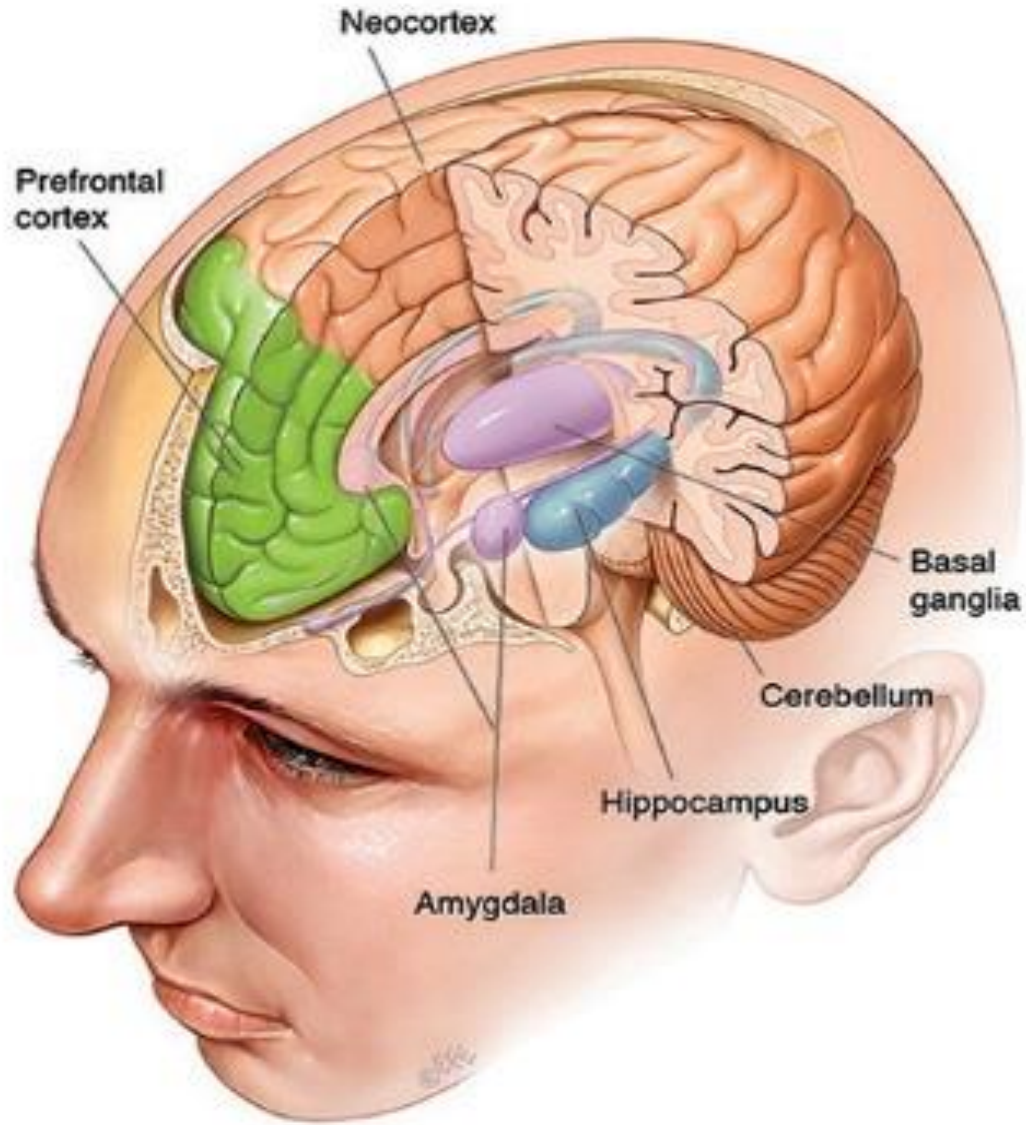

Neocortex
Thalamus
Hypothalamus
Amygdala
Hippocampus
Locus
coeruleus
Cerebellum
To spinal cord

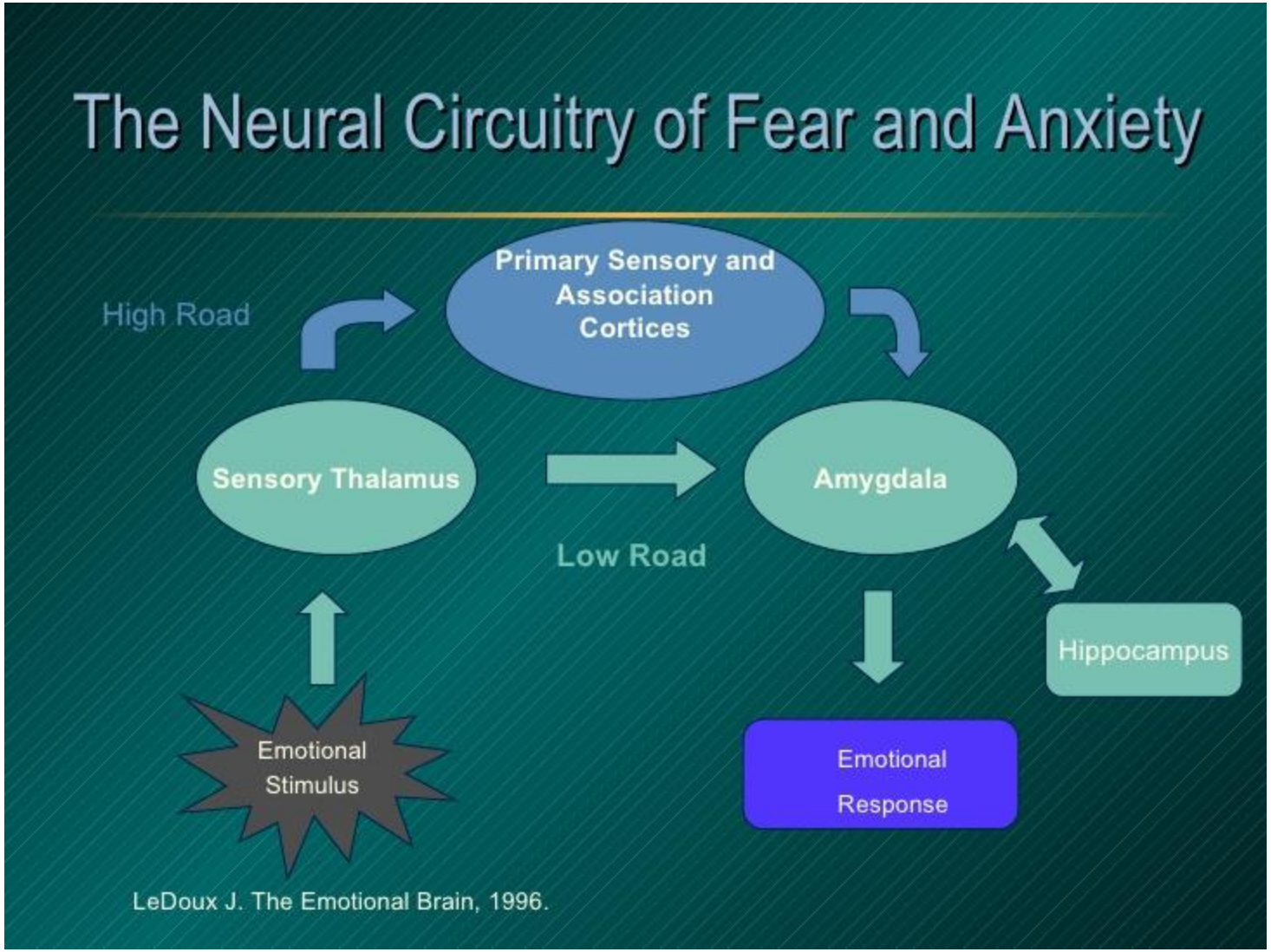
Noradrenergic System

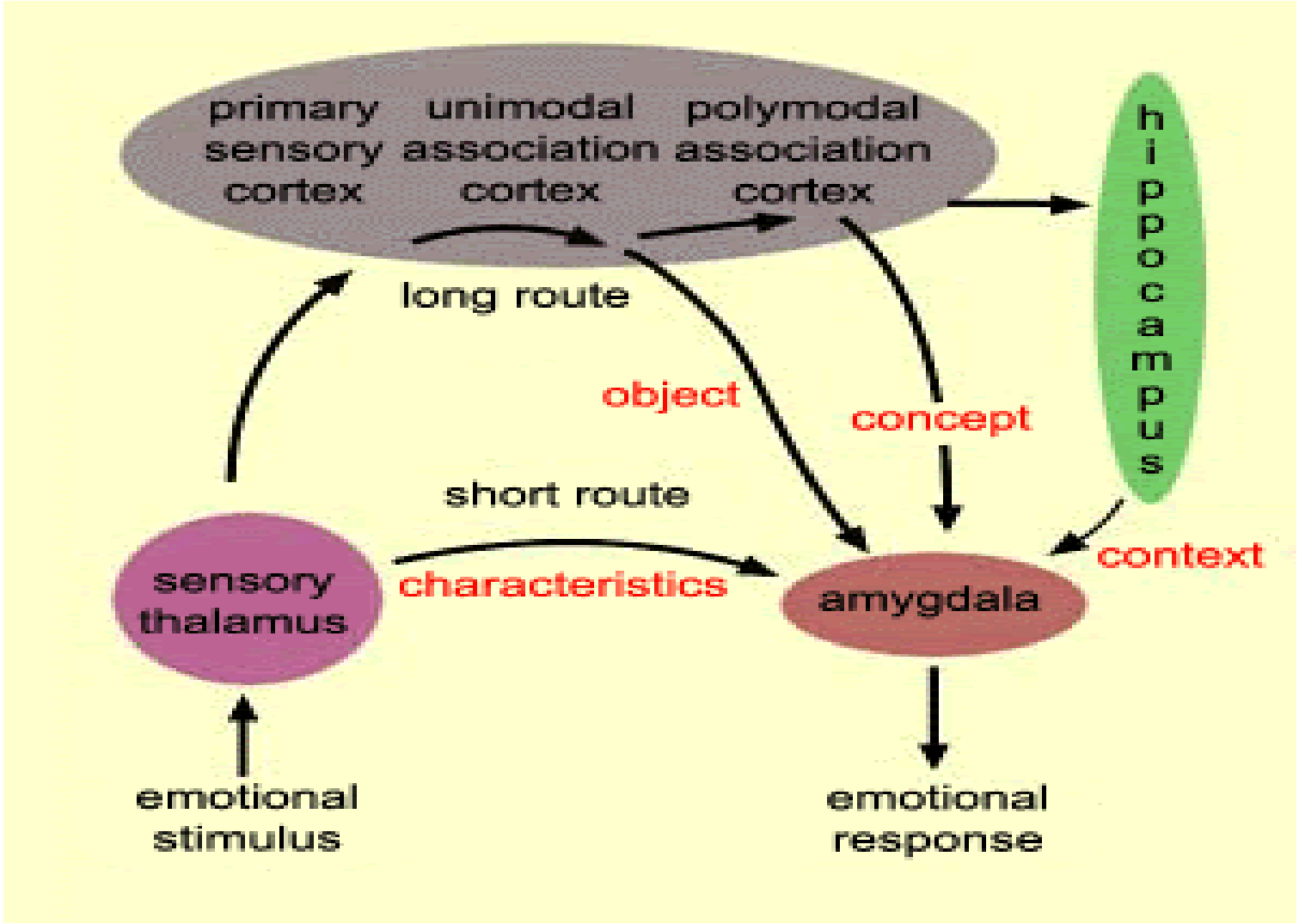
- Core neurons are in the *locus coeruleus* in the pons
- Targets are spinal cord, cerebellum, hypothalamus, thalamus, and most of neocortex
- Noradrenalin is released
- Functions are complex
- Involved in regulation of attention, arousal, and sleep-wake cycles
- Core neurons are activated by novel, non-painful sensory stimuli
- General increase of brain responsiveness

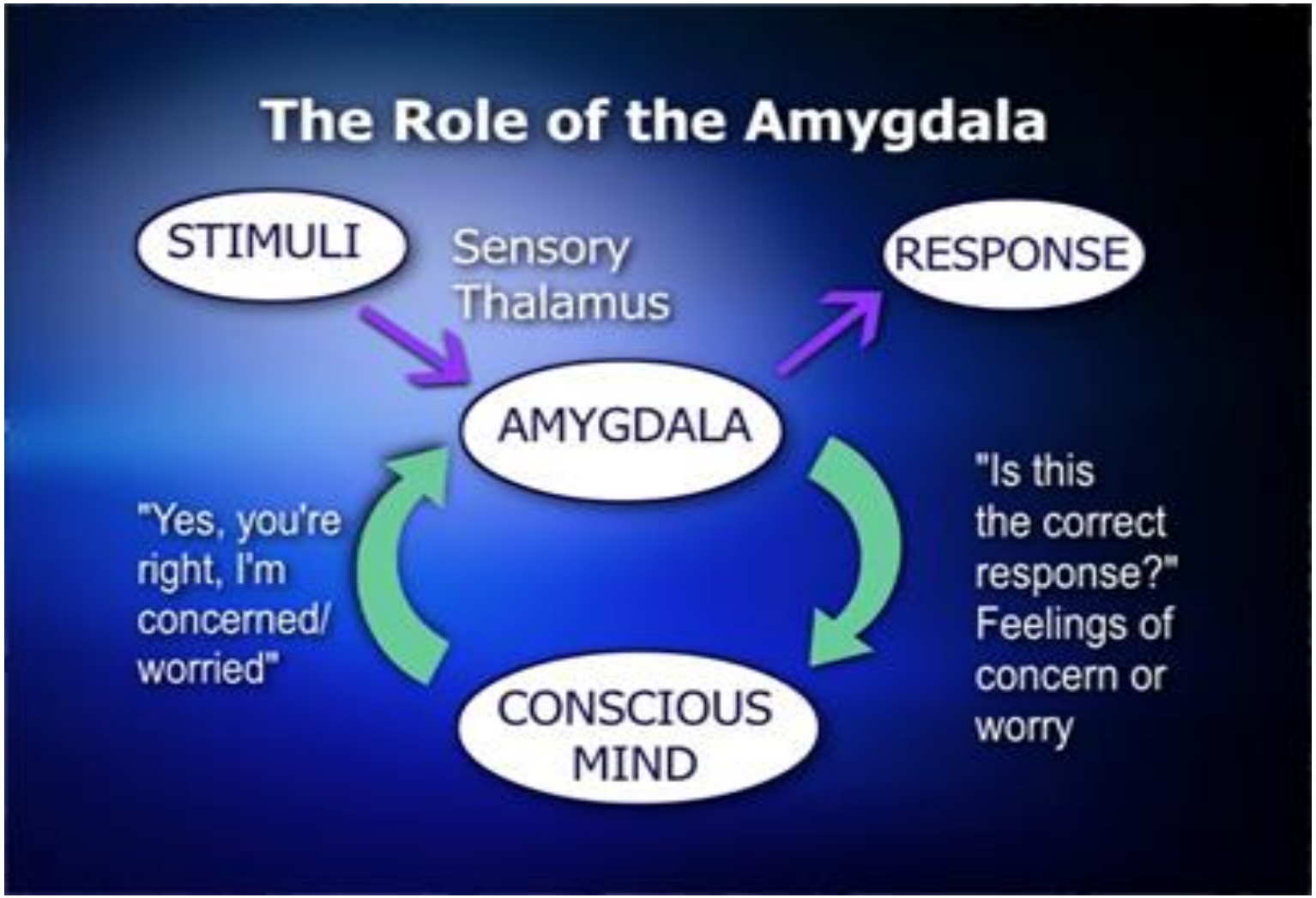
روانشناسی پزشکی و نوروپسیکولوژی، جلسه سیزدهم

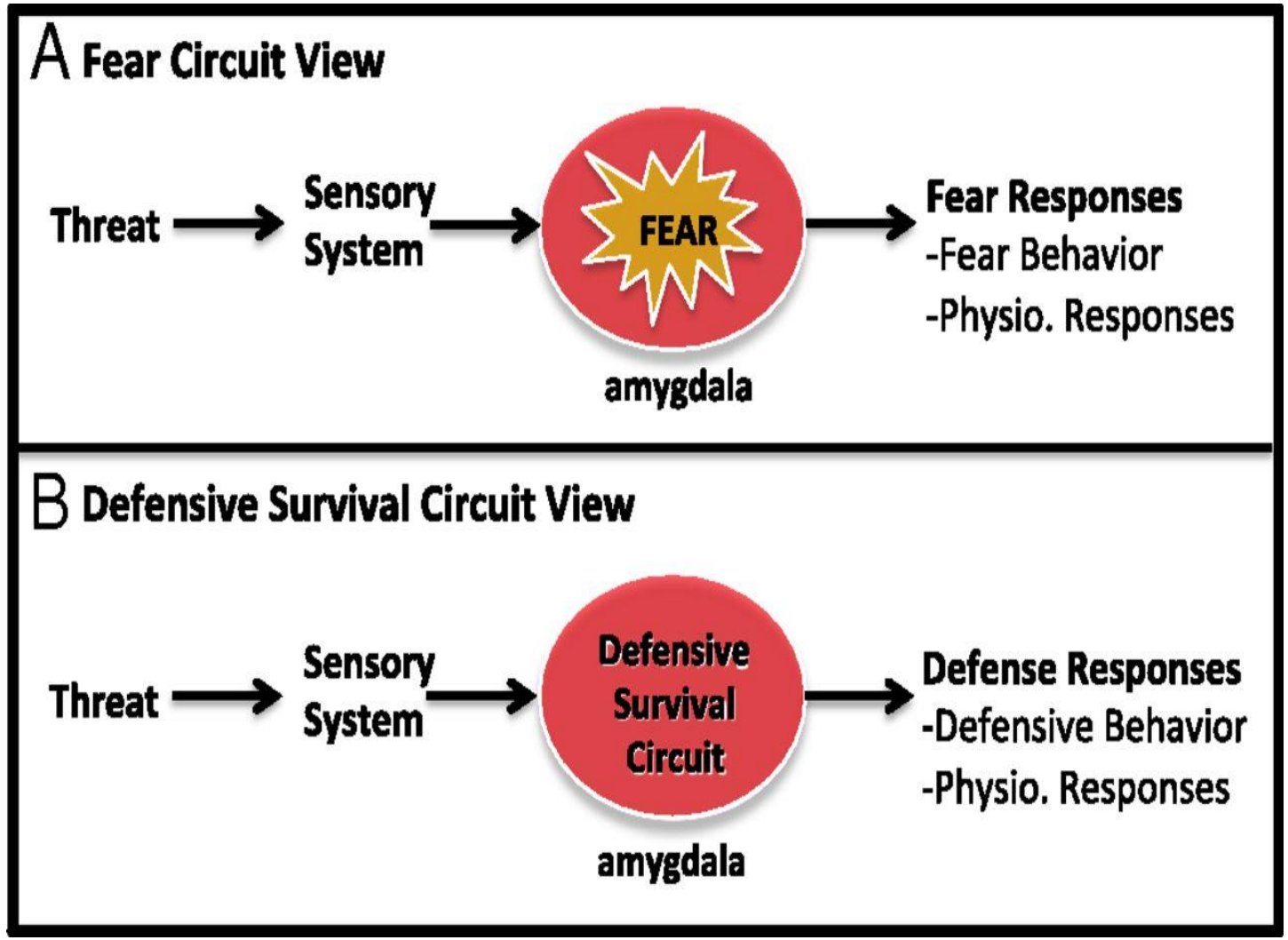
اهمیت دستگاه لیمبیک و ارتباطات دوجانبه آن با قشر پیشانی در اختلالات رفتاری


Neocortex
Prefrontal cortex
Basal ganglia
Cerebellum
Hippocampus
Amygdala

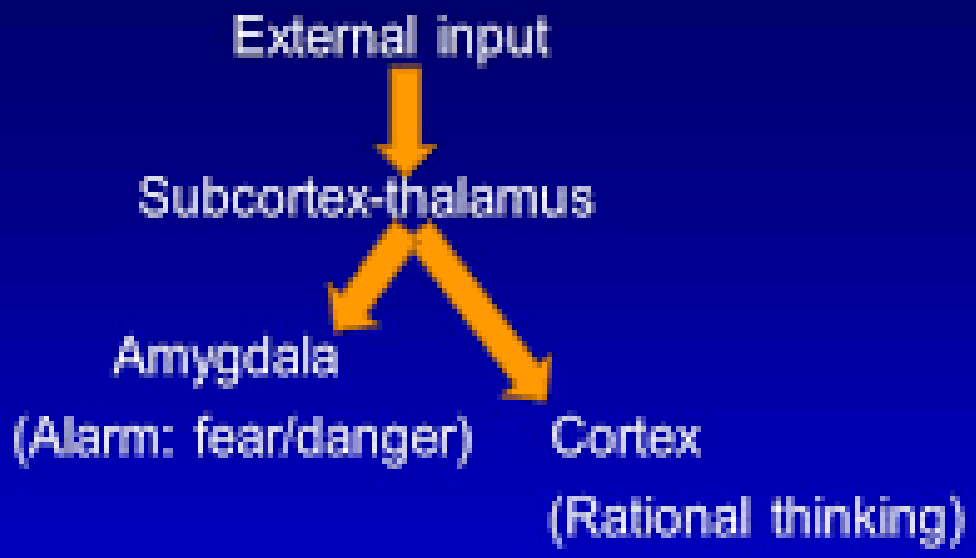

The Neural Circuitry of Fear and Anxiety
High Road
Primary Sensory and Association Cortices
Sensory Thalamus
Amygdala
Low Road
Hippocampus
Emotional Stimulus
Emotional Response
LeDoux J. The Emotional Brain, 1996.


primary sensory cortex
unimodal association cortex
polymodal association cortex
hippocampus
long route
object
concept
short route
sensory thalamus
characteristics
amygdala
context
emotional stimulus
emotional response


The Role of the Amygdala
STIMULI
Sensory
Thalamus
RESPONSE
AMYGDALA
"Yes, you're right, I'm concerned/ worried"
"Is this the correct response?" Feelings of concern or worry
CONSCIOUS MIND

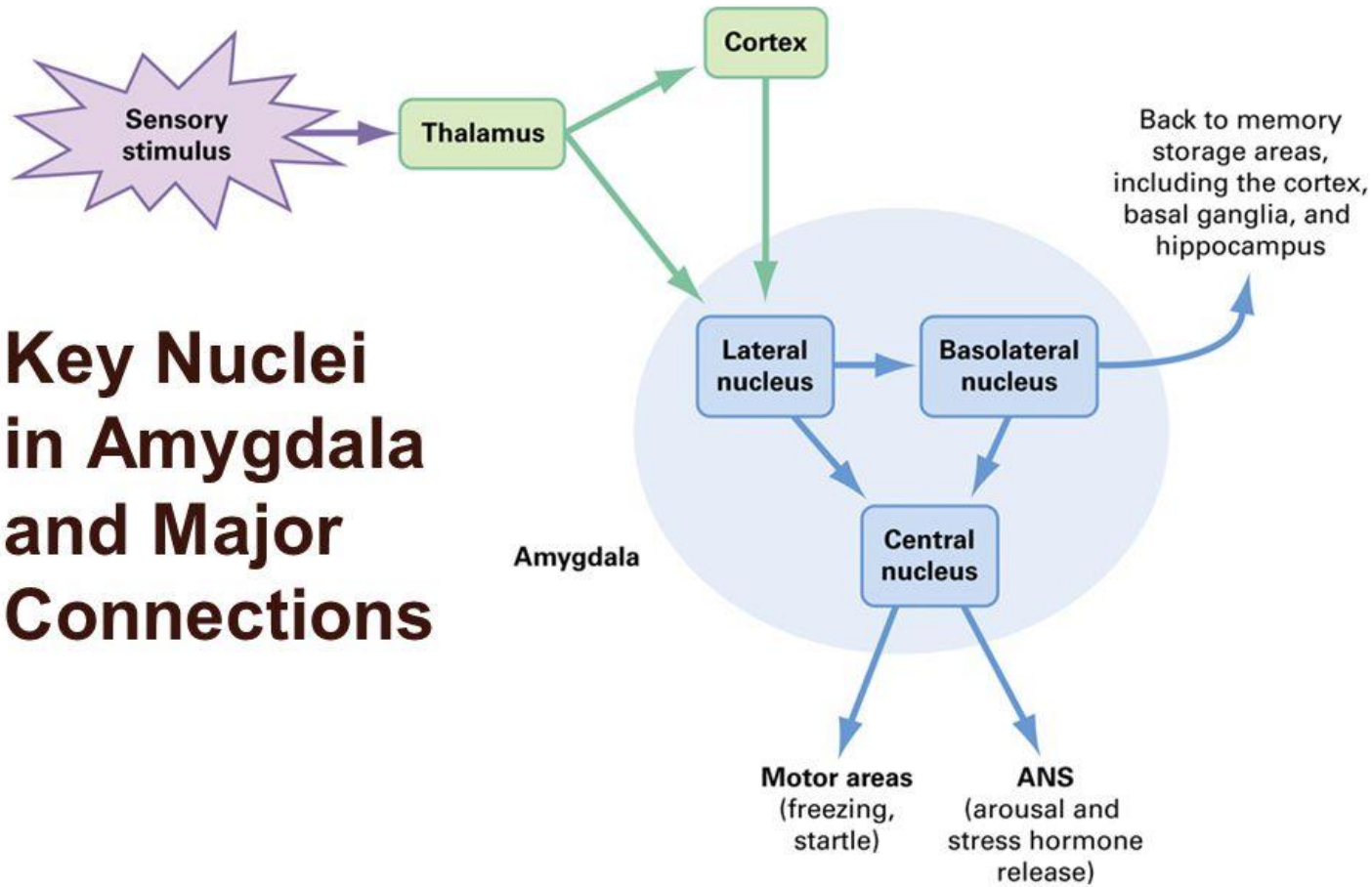

A Fear Circuit View
Threat
Sensory System
FEAR
amygdala
Fear Responses
-Fear Behavior
-Physio. Responses
B Defensive Survival Circuit View
Threat
Sensory System
Defensive Survival Circuit
amygdala
Defense Responses
-Defensive Behavior
-Physio. Responses

Fight/Flight/Freeze Response



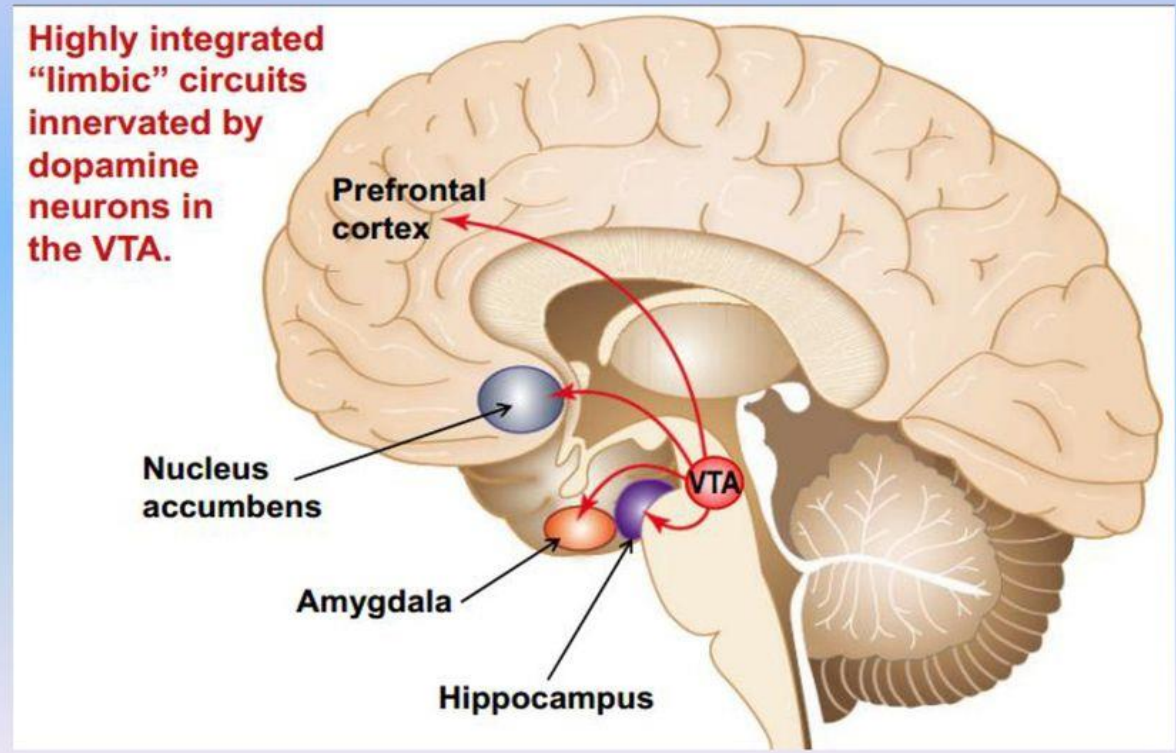
- Response to cortex is 22 milliseconds slower than the response from the amygdale
- Amygdale also triggers glucose release

Key Nuclei in Amygdala and Major Connections

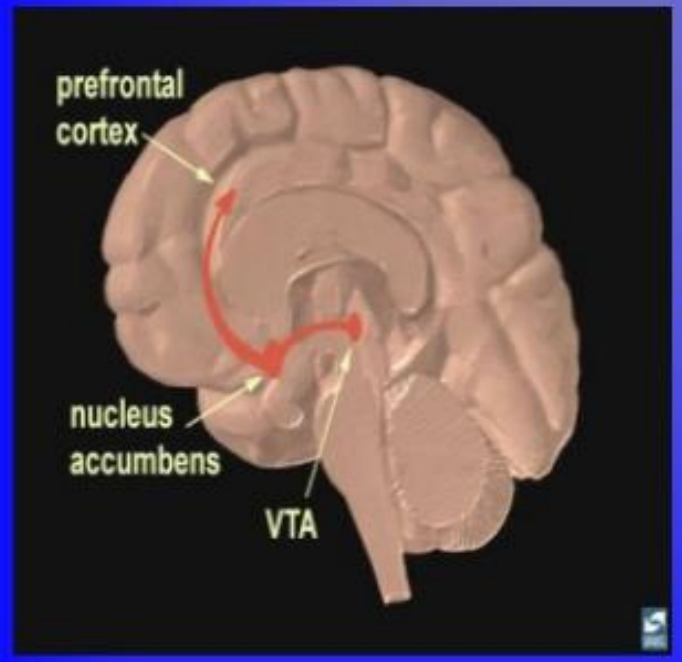


After LeDoux, 1998, 2000; McGaugh, 2002.

Brain Reward Regions



The reward pathway



- ✓ Ventral Tegmental Area(VTA),
- ✓ Nucleus accumbens (NA) &
- ✓ Prefrontal cortex (PFC).

- ➢ VTA is connected to both NA & PFC via this pathway sending information via its dopaminergic neurons,

- ➢ Dopamine released in NA & PFC

From Mice to Men:
Reward Pathway in Humans