

Introduction to Neurobiology of Mental Disorders

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(A concise, structured overview for study or review)

1. Core Concepts

Concept	Definition	Relevance to Mental Disorders
Neurotransmission	Release of chemical messengers (neurotransmitters) from a presynaptic neuron, binding to receptors on a postsynaptic cell, and termination of the signal.	Imbalances in serotonin, dopamine, norepinephrine, GABA, and glutamate underlie many mood, anxiety, and psychotic disorders.
Neuroplasticity	The brain's ability to change its structure and function in response to experience, learning, or injury.	Dysregulated plasticity can contribute to persistent maladaptive circuits (e.g., in depression or PTSD).
Neurocircuitry	Networks of interconnected brain regions that process specific types of information (e.g., reward, fear, executive control).	Specific circuit dysfunctions are linked to symptom clusters (e.g., hyperactive amygdala in anxiety).
Gene-Environment Interaction (G×E)	The interplay between genetic susceptibility and environmental exposures (stress, trauma, substance use).	Explains why not all genetically "at-risk" individuals develop a disorder and why environmental factors can trigger illness.

2. Major Brain Systems Implicated in Psychiatric Illness

System	Key Structures	Primary Functions	Typical Dysfunctions in Disorders
Monoaminergic System	Raphe nuclei (serotonin), Locus coeruleus (norepinephrine), Ventral tegmental area (dopamine)	Mood regulation, arousal, reward, attention	? Serotonin ? depression, anxiety; ? Dopamine ? psychosis; ? Norepinephrine ? ADHD, depression

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System	Key Structures	Primary Functions	Typical Dysfunctions in Disorders
Limbic System	Amygdala, Hippocampus, Ventral striatum	Emotion processing, memory, reward	Amygdala hyperactivity ? anxiety/PTSD; Hippocampal volume loss ? depression, PTSD
Prefrontal Cortex (PFC)	Dorsolateral PFC, Ventromedial PFC, Anterior cingulate	Executive function, decision making, impulse control	Hypofrontality ? schizophrenia, ADHD; Dysregulated ventromedial PFC ? mood disorders
Default Mode Network (DMN)	Medial PFC, Posterior cingulate, Precuneus	Self-referential thought, mind wandering	Hyperconnectivity ? rumination in depression; hypoconnectivity ? attentional deficits
Salience Network	Anterior insula, Dorsal anterior cingulate	Detects salient stimuli, switches between DMN & task-positive networks	Aberrant salience attribution ? psychosis; altered switching ? anxiety
HPA Axis (Neuroendocrine)	Hypothalamus ? Pituitary ? Adrenal cortex	Stress response, cortisol release	Chronic hypercortisol ? hippocampal atrophy, mood dysregulation

3. Neurotransmitter Systems & Representative Disorders

Neurotransmitter	Primary Receptors	Pharmacologic Targets	Representative Disorders
Serotonin (5-HT)	5-HT _{1A} , 5-HT _{2A} , 5-HT ₃ , etc.	SSRIs, SNRIs, 5-HT _{2A} antagonists	Major depressive disorder (MDD), OCD, anxiety disorders, some eating disorders
Dopamine	D ₁		