

Central nervous system Pharmacology

Central Nervous System (CNS) Pharmacology

- CNS pharmacology deals with drugs that act on the brain and spinal cord, influencing functions like thinking, movement, mood, sleep, and behavior.

Basic Organization of CNS

- The CNS consists of:
 - **Brain** → controls higher functions (thinking, emotions)
 - **Spinal cord** → conducts impulses and controls reflexes
- Neurons communicate using **neurotransmitters**, which are chemicals released at synapses.

Important Neurotransmitters in CNS

1. Excitatory Neurotransmitters

- Increase neuronal activity
- **Example:** Glutamate
- Causes depolarization → neuron fires

2. Inhibitory Neurotransmitters

- Decrease neuronal activity
- **Examples:**
 - **GABA (Gamma Aminobutyric Acid)** → main inhibitory neurotransmitter
 - **Glycine**

3. Modulatory Neurotransmitters

- These do not directly excite or inhibit but **modify neuronal activity**:
 - Dopamine → movement, reward
 - Serotonin → mood, sleep
 - Noradrenaline → alertness
 - Histamine → wakefulness

Receptors in CNS

- **Ionotropic Receptors**
 - Fast acting
 - Directly open channels
 - **Example:** NMDA receptor (glutamate)

Metabotropic Receptors

- Slow acting
- Work through second messengers
- **Example:** dopamine receptors

Blood-Brain Barrier (BBB)

- Protects brain from harmful substances
- **Only allows:**
 - Lipid-soluble drugs
 - Drugs with transporters

Key Principles of CNS Drug Action

- **Drugs may:**
 - Stimulate (e.g., stimulants)
 - Depression (e.g., sedatives)
 - Modify neurotransmitters
- **CNS drugs often have:**
 - Complex effects
 - Side effects like sedation and confusion

Clinical Importance

- **Used in treating:**
 - Anxiety
 - Depression
 - Epilepsy
 - Parkinson's disease
 - Pain

General Anesthetics (CNS Pharmacology)

- **General anesthetics** are drugs that produce reversible loss of consciousness along with absence of pain sensation, allowing surgical procedures to be performed.

Stages of General Anesthesia

Stage I: Analgesia

- Patient is conscious

- Pain sensation reduced

Stage II: Excitement

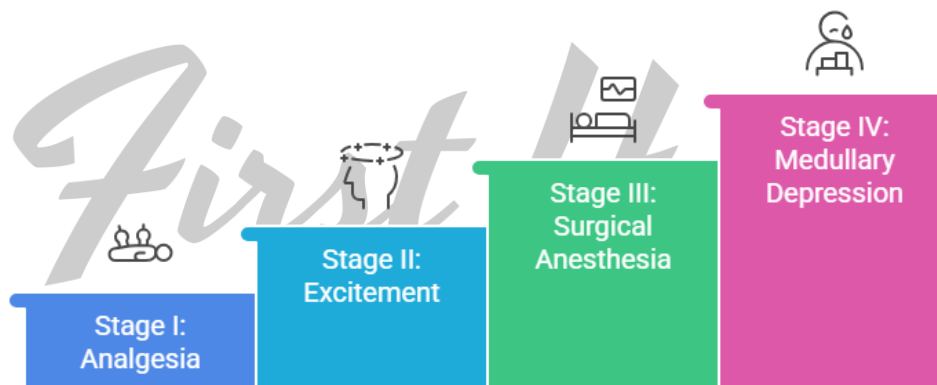
- Irregular breathing
- Increased reflexes
- Undesirable stage

Stage III: Surgical Anesthesia

- Desired stage
- Loss of consciousness
- Muscle relaxation
- Regular breathing

Stage IV: Medullary Depression

- Dangerous stage
- Respiratory and cardiovascular collapse



Mechanism of Action

- **General anesthetics act mainly by:**
 - Enhancing inhibitory neurotransmission (GABA)
 - Reducing excitatory neurotransmission (glutamate)

Types of General Anesthetics

1. Inhalational Anesthetics

- Given via lungs

Characteristics:

- Rapid onset and recovery
- Controlled easily

2. Intravenous Anesthetics

- Given through veins

Characteristics:

- Rapid induction
- Used for short procedures

Pharmacological Effects

A. CNS

- Loss of consciousness
- Amnesia

B. Cardiovascular System

- Decreased blood pressure
- Variable heart rate

C. Respiratory System

- Respiratory depression

D. Muscles

- Relaxation

Toxicology

1. Respiratory Depression

- Major risk

2. Hypotension

- Due to vasodilation

3. Malignant Hyperthermia

- Rare but serious condition

Clinical Uses

- Surgery
- Diagnostic procedures

Novel Developments

- Targeted anesthetics
- Safer agents with rapid recovery

Local Anesthetics

- **Local** anesthetics produce loss of sensation in a specific area without loss of consciousness.

Mechanism of Action

- Block **voltage-gated sodium (Na^+) channels**
- Prevent nerve impulse conduction

Types

1. Surface Anesthesia

- Applied on skin or mucous membrane

2. Infiltration Anesthesia

- Injected into tissue

3. Nerve Block

- Injected near nerve

4. Spinal/Epidural

- Injected into spinal region

Pharmacological Effects

- Loss of pain sensation
- No effect on consciousness

Factors Affecting Action

- pH of tissue
- Blood flow
- Lipid solubility

Toxicology

1. CNS Toxicity

- Tremors
- Convulsions

2. Cardiotoxicity

- Arrhythmias

Clinical Uses

- Minor surgery
- Dental procedures
- Labor analgesia

Novel Aspects



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