

Pharmacology Overview

Key concepts and mechanisms of action



Introduction to Pharmacology

Pharmacology is the study of drugs and their effects on living systems. It encompasses how drugs are absorbed, distributed, metabolized, and eliminated (ADME), as well as their therapeutic and adverse effects. Understanding pharmacology is crucial for healthcare professionals to safely and effectively prescribe and administer medications.

Key Concepts

Pharmacokinetics:

What the body does to the drug. This involves:

- **Absorption:** How the drug enters the bloodstream.
- **Distribution:** How the drug travels to different parts of the body.
- **Metabolism:** How the drug is broken down by the body.
- **Excretion:** How the drug is removed from the body.

Pharmacodynamics:

What the drug does to the body. This includes:

- **Mechanism of action:** How the drug works at the molecular level.
- **Therapeutic effects:** The desired beneficial effects of the drug.
- **Adverse effects:** The undesired or harmful effects of the drug.
- **Drug interactions:** How drugs affect each other.

Drug Classifications

Drugs can be classified in several ways, including:

- **By therapeutic use:** Antihypertensives (lower blood pressure), antibiotics (fight bacterial infections), analgesics (relieve pain).
- **By mechanism of action:** Beta-blockers (block beta-adrenergic receptors), ACE inhibitors (inhibit angiotensin-converting enzyme).
- **By chemical structure:** Penicillins, tetracyclines, benzodiazepines.

Mechanisms of Action

Drugs exert their effects by interacting with specific targets in the body, such as:

- **Receptors:** Proteins that bind to drugs and initiate a cellular response. For example, opioids bind to opioid receptors to relieve pain.
- **Enzymes:** Proteins that catalyze biochemical reactions. For example, ACE inhibitors block the ACE enzyme to lower blood pressure.
- **Ion channels:** Proteins that regulate the flow of ions across cell membranes. For example, calcium channel blockers block calcium channels to treat hypertension and angina.
- **Transporters:** Proteins that transport molecules across cell membranes. For example, selective serotonin reuptake inhibitors (SSRIs) block the reuptake of serotonin to treat depression.

Important Considerations

- **Dosage:** The amount of drug to be administered. It is important to get correct dose, as well as timings.
- **Route of administration:** How the drug is given (e.g., oral, intravenous, intramuscular, subcutaneous).
- **Bioavailability:** The fraction of the administered dose that reaches systemic circulation unchanged.
- **Half-life:** The time it takes for the concentration of a drug in the body to decrease by half.
- **Adverse drug reactions (ADRs):** Undesirable effects of a drug. These can range from mild (e.g., nausea, headache) to severe (e.g., anaphylaxis, organ damage).
- **Drug interactions:** When one drug affects the action of another drug. This can lead to increased or decreased effects.
- **Patient factors:** Age, weight, genetics, and other medical conditions can influence drug response.
- **Therapeutic Index:** A ratio that compares the blood concentration at which a drug is toxic and the concentration at which the drug is effective.