

Introduction to Pharmacology

Introduction to Pharmacology – Study Notes

1. What Is Pharmacology?

- **Definition:** The scientific discipline that studies drugs and their interactions with living organisms.
 - **Scope:**
 - **Pharmacodynamics** – what the drug does to the body.
 - **Pharmacokinetics** – what the body does to the drug.
 - **Therapeutics** – clinical use of drugs to treat disease.
 - **Toxicology** – harmful effects and overdose management.
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2. Basic Terminology

Term	Meaning
Drug	Any chemical substance that produces a physiological effect when administered.
Ligand	Molecule that binds to a receptor (e.g., neurotransmitter, hormone, drug).
Receptor	Protein (membrane-bound or intracellular) that recognizes and responds to a ligand.
Agonist	Binds to a receptor and activates it, producing a biological response.
Antagonist	Binds to a receptor but blocks activation, preventing a response.
Partial agonist	Produces a sub-maximal response even when all receptors are occupied.
Inverse agonist	Binds to the same receptor as an agonist but induces the opposite effect.
Efficacy	Ability of a drug to produce a maximal response.
Potency	Amount of drug needed to produce a given effect (lower dose = higher potency).
Therapeutic index (TI)	Ratio of toxic dose to effective dose; a measure of safety.

3. Pharmacodynamics (PD) – “Drug ? Body”

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1. Receptor Interaction

- **Binding affinity** ? strength of drug?receptor binding.
- **Signal transduction** ? cascade leading to cellular response (e.g., second messengers, ion channel opening).

2. Dose?Response Relationship

- **Graded (continuous) curve** – single subject, varying dose.
- **Quantal (all?or?none) curve** – population response (e.g., % of patients achieving desired effect).

3. Factors Influencing PD

- Receptor number/density.
- Receptor affinity & intrinsic activity.
- Presence of **allosteric modulators** (enhance or inhibit receptor response).

4. Pharmacokinetics (PK) – “Body ? Drug”

Phase	Key Processes	Primary Organs	Clinical Relevance
Absorption	Transfer from site of administration into systemic circulation	GI tract, skin, lungs	Bioavailability, onset of action
Distribution	Movement of drug from blood to tissues	Blood, plasma proteins, adipose tissue	Volume of distribution, tissue targeting
Metabolism	Chemical alteration (mostly hepatic)	Liver (cytochrome P450 enzymes)	Activation/inactivation, drug? drug interactions
Excretion	Removal from the body	Kidneys (urine), liver (bile), lungs (exhaled)	Clearance, half?life, dosing interval

- **Half?life ($t_{1/2}$):** Time required for plasma concentration to fall by 50%.
- **Clearance (Cl):** Volume of plasma cleared of drug per unit time.
- **Bioavailability (F):** Fraction of administered dose reaching systemic circulation (0–1).

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5. Major Drug Classes (Examples)

| Class