INTRODUCTION TO PHARMACOLOGY

Khder Hussein Rasul

Pharmacology, MA 411

Spring Semester

Second week

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Outline

- Introduction to some terms in pharmacology
- Nature and size of drugs.

Objectives

- The definition and meaning of some terms in pharmacology.
- The nature of drugs in terms of shapes and sizes that influence their reactivity with receptors.

Pharmacology and drugs

- **Pharmacology** is the branch of science that studies drugs and their interactions with living organisms. It involves understanding how drugs work, their effects, mechanisms of action, therapeutic uses, and potential side effects.
- A **drug** can be broadly defined as any chemical substance, natural or synthetic, which affects a biological system.

Source of drugs

Drugs can be derived from

A. Natural sources, like

1. Plants such as morphine
2. Animals such as insulin
3. Microorganisms such as penicillin

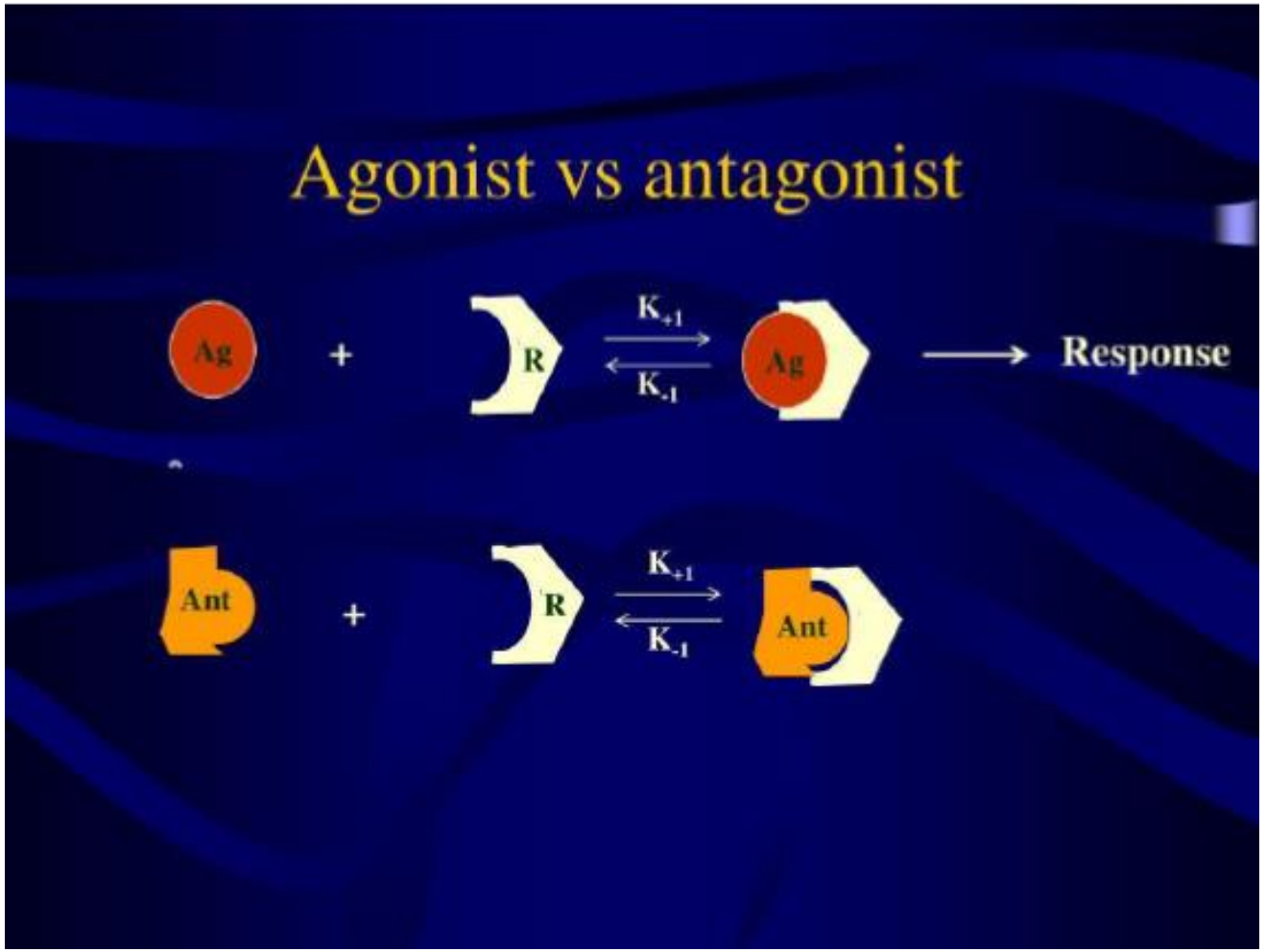
A. Synthetic sources: Created in laboratories to improve potency and reduce side effects. Example: paracetamol

Semisynthetic Drugs: Modified natural compounds to enhance effectiveness. Example: Ampicillin (modified from penicillin)

Agonist and antagonist

- An **agonist** is a substance (drug) that binds to a receptor and activates it, causing a biological response.

- An **antagonist** is a substance (drug) that binds to a receptor but does not activate it. Instead, it blocks or inhibits the action of an agonist.



Physical nature of drug

- The physical nature of a drug refers to its **physical properties**, which significantly influence its **absorption**, **distribution**, **metabolism**, and **excretion** in the body.
- The physical nature encompasses aspects such as

1. State of matter (drug)
2. Particle size
3. Shape
4. Molecular structure
5. Polarity.

- A drug is administered at a location distant from its intended site of action (to be transported).
- A drug should act for an appropriate duration (be inactivated or excreted).

Physical nature of drug

- **States of Matter**

Drugs can exist in different states of matter, each with its own impact on how the drug interacts with the body.

1. **Solid:** Solid drugs can be in the form of tablets, capsules, or powders.
2. **Liquid:** Liquid drugs are generally easier to absorb and distribute because they are in a liquid state.
3. **Gas:** Gaseous drugs, such as anesthetics (e.g., nitrous oxide), are usually administered via inhalation

Physical nature of drug

- **Size of drug**
- The molecular size of drugs varies from very small to very large.
- The size of a drug molecule can influence its ability to **penetrate biological membranes**.
- Generally, smaller molecules are more easily absorbed, whereas larger molecules may require specialized transport mechanisms.
- Large drugs do not diffuse readily between compartments of the body.
- Large drugs (usually proteins) must often be administered directly into the compartment where they have their effect.

Physical nature of drug

- **Drug shape**
- The shape of drug molecules has influence on their actions
- The shape of a drug molecule must be appropriate enough to permit binding to its receptor site.
- Optimally, the drug's shape is complementary to that of the receptor site in the same way that a key is complementary to a lock.

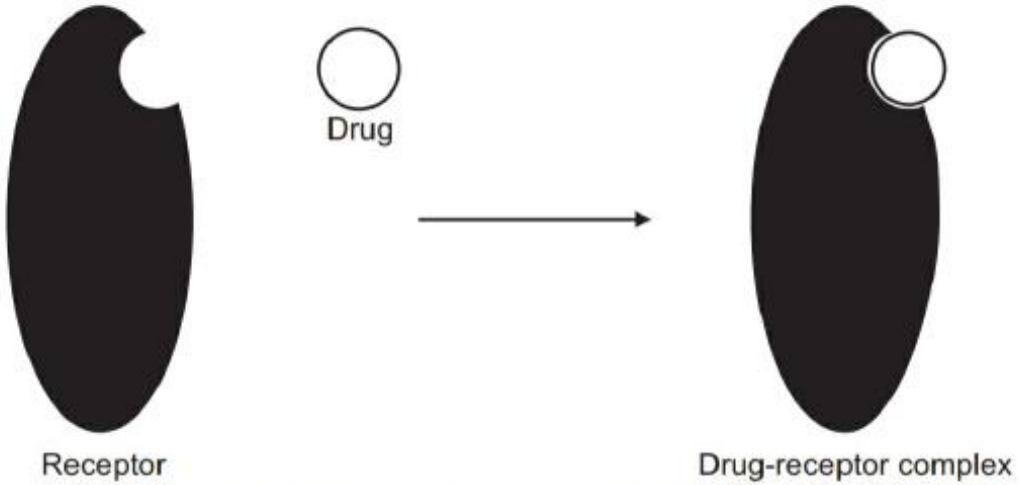


Fig. 2.1: Lock-key drug receptor interaction

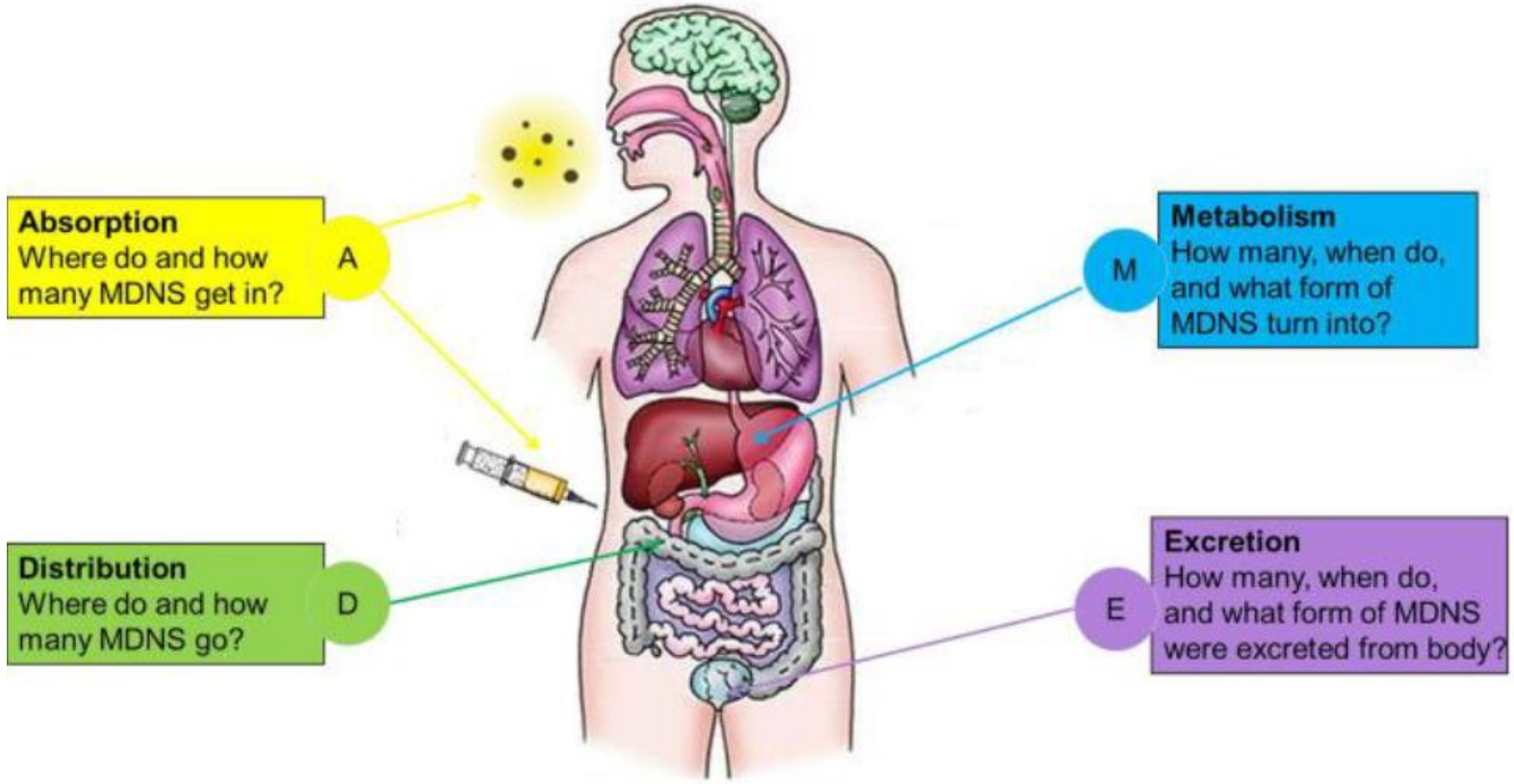
$$D + R \underset{k_{off}}{\overset{k_{on}}{\rightleftharpoons}} DR$$

Fig. 2.2: Rate of binding and release

Pharmacokinetics

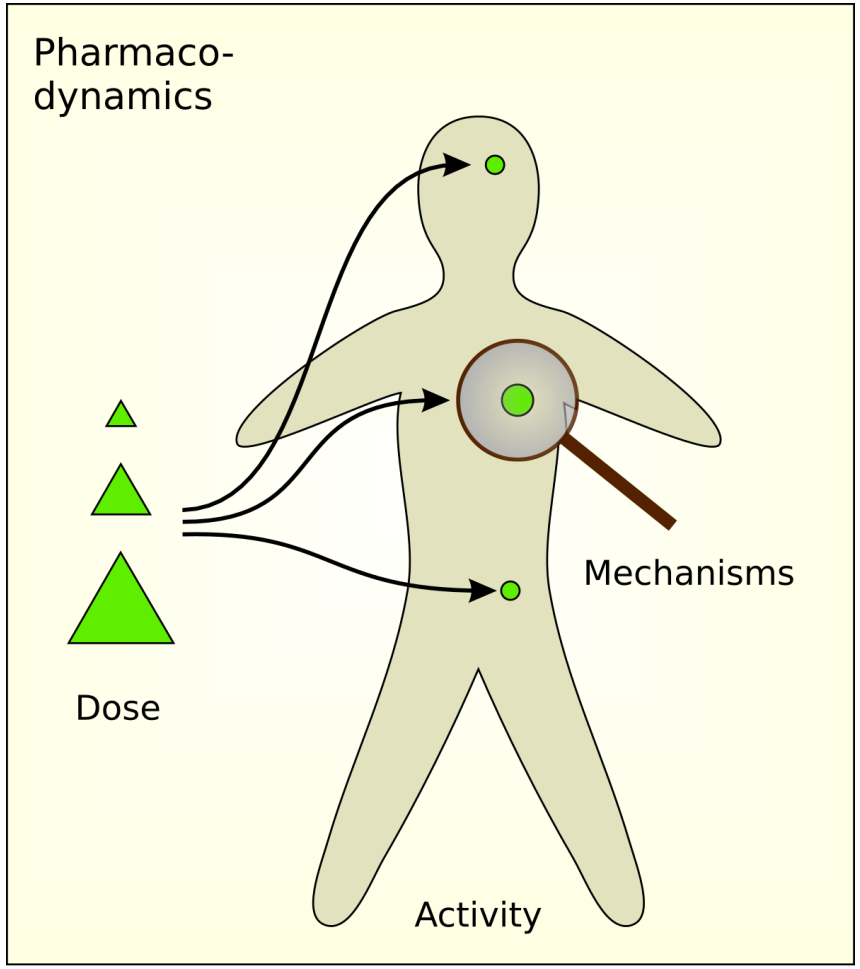
- **Pharmacokinetics (PK)** is the study of how drugs move through the body.
- It describes the processes of

1. Absorption
2. Distribution
3. Metabolism
4. Excretion



Pharmacodynamics

- **Pharmacodynamics (PD)** is the study of the effects of drugs on the body and how they exert their action at the molecular, cellular, and systemic levels.



Pharmacogenomics

- **Pharmacogenomics** is the study of how an individual's genetic makeup influences their response to drugs.