Pharmacology  
**An Introduction**

theoretical

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* **Pharmacology :** is the study of drugs.
* the term *drug* commonly means any medication that is used for diagnosing, curing, or treating disease.

The goal of drug therapy is to **prevent**, **cure**, or **control** various disease states. To achieve this goal, adequate drug **doses** must be delivered to the **target tissues** so that therapeutic yet nontoxic levels are obtained.

**GENERAL PRINCIPLES OF PHARMACOLOGY** ...............................

**- The Nature of Drugs**

In the most general sense, a drug may be **defined** as any substance that brings about a change in biologic function through its chemical actions.

In the great majority of cases, the drug molecule interacts with a specific molecule in the biologic system that plays a regulatory role.

This molecule is called a **receptor**.

In a very small number of cases, drugs known as chemical antagonists may interact directly with other drugs, whereas a few drugs (osmotic agents) interact almost exclusively with water molecules.

Drugs may be synthesized within the body (eg, **hormones**) or may be chemicals *not* synthesized in the body, ie, **xenobiotics** (from the Greek *xenos*, meaning "**stranger**").

**Poisons** are drugs that have almost exclusively harmful effects.

**However, Paracelsus (1493-1541) famously stated that "the dose makes the poison," meaning that almost all substances can be harmful if taken in the wrong dosage.**

**Toxins** are usually defined as poisons of biologic origin, ie, synthesized by plants or animals, in contrast to inorganic poisons such as lead and arsenic.

To interact chemically with its receptor, a drug molecule must have the appropriate **size**, **electrical charge**, **shape**, and **atomic composition**.

Furthermore, a drug is often administered at a location distant from its intended site of action, eg, a pill given orally to relieve a headache. Therefore, a useful drug must have the necessary properties to be transported from its site of administration to its site of action.

Finally, a practical drug should be inactivated or excreted from the body at a reasonable rate so that its actions will be of appropriate duration.

**- Drug-Body Interactions** .......................................

The interactions between a drug and the body are conveniently divided into two classes.

**1- Pharmacodynamic**

**2- Pharmacokinetic**

The actions of the drug on the body are termed **pharmacodynamic** processes

- These properties determine the group in which the drug is classified and play the major role in deciding whether that group is appropriate therapy for a particular symptom or disease

The actions of the body on the drug are called **pharmacokinetic** processes

Pharmacokinetic processes govern the absorption, distribution, metabolism and elimination of drugs and are of great practical importance in the choice and administration of a particular drug for a particular patient, **eg**, a patient with impaired renal function

**TERMINOLOGY RELATED  
TO DRUG EFFECTS**

Another basic question that should be answered is **“What**

**actually is a drug? ”** Every pure drug is a chemical compound with a specific chemical structure. Because of its structure,

a drug has certain properties that are usually divided into **chemical** properties and **biological** properties.

The properties of any drug determine what effects will be produced when the drug is administered.

An important fact to remember is that, structurally, the human body is composed mostly of cells, even though these cells are highly organized into tissues, organs, and systems. Consequently, drugs produce effects by influencing the function of cells.

Pharmacologists know that all drugs produce more than one effect.

Every drug produces its intended effect, or **therapeutic effect,** along with other effects.

The therapeutic use(s) of any drug is referred to as the **drug indication,** meaning indications for use.

The term **contraindication** refers to the situation or circumstance when a particular drug should *not* be used.

Some drug effects, other than therapeutic effects, are described as undesirable.

Undesired drug effects are categorized as side effects, adverse effects, and **toxic effects**.

**- Side Effects**

Many **side effects** are more of a nuisance than they are harmful.

The dry mouth and sedation caused by some antihistamine drugs is an example.

In many cases drug side effects must be tolerated in order to benefit from the therapeutic actions of the drug.

**- Adverse Effects**

**Adverse effects** are also undesired effects, but these are effects that may be harmful **(persistent diarrhea, vomiting, or central nervous system [CNS] disturbances such as confusion)** or that with prolonged treatment may cause conditions that affect the function of vital organs such as the liver or kidney.

Reduction of dosage or switching to an alternative drug often will avoid or minimize these harmful consequences.

**- Toxic Effects**

**Toxic effects,** or toxicity, means drug poisoning , the consequences of which can be extremely harmful and may be ***life-threatening***.

In these situations, the drug must be stopped and supportive treatment and the administration of antidotes may be required.

BASIC CONCEPTS IN  
**PHARMACOLOGY**

* **Site of Action**

The **site of action** of a drug is the location within the body where the drug exerts its therapeutic effect.

For example, the site of action of aspirin to reduce fever is in an area of the brain known as the hypothalamus. Within the hypothalamus the temperature-regulating center controls and maintains body temperature.

Aspirin alters the activity of the hypothalamus so that body temperature is reduced.

* **Mechanism of Action**

**Mechanism of action** explains how a drug produces its effects. For example,

local anesthetic agents produce a loss of pain sensation by interrupting nerve conduction in sensory nerves. In order for nerve impulses to be conducted, **sodium** ions must pass through the nerve membrane.

Local anesthetic agents attach to the nerve membrane and prevent the passage of sodium ions.

Consequently, sensory nerve impulses for pain are not conducted to the pain centers in the brain. Knowledge of the mechanism of action of drugs is essential to understanding why drugs produce the effects that they do.

* **Receptor Site**

Drug action is usually thought to begin after a drug has attached itself to some chemical structure located on the outer cell membrane or within the cell itself.

For a few drugs and for some normal body substances, there seems to be a specific location on certain cells. This area is referred to as the ***receptor*** site.

The attachment, or binding, of a drug to its receptors begins a series of cell changes referred to as the drug action.

The receptors for **morphine** are located in the brain and are known as the morphine, or opioid, receptors. When morphine binds to its receptors, it produces cell changes that reduce the perception of pain.

* **Agonists and Antagonists**

Drugs that bind to specific receptors and produce a drug action are called **agonists.**

Morphine is an example of an agonist.

Drugs that bind to specific receptors and inhibit agonist drug action or cellular functions are called **antagonists.**

Antagonists are also known as blocking drugs. Usually, antagonists bind to the receptors and prevent other drugs or body substances from producing an effect.

Naloxone, a morphine antagonist, is administered to prevent, or antagonize, the effects of morphine in cases of morphine overdose.

When both agonist and antagonist drugs bind to the same receptor and are administered together, they **compete** with each other for the same receptor site. This effect is known as ***competitive antagonism.***

The amount of drug action produced depends on which drug (agonist or antagonist) occupies the greatest number of receptors.

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