صيدلانيات ١

د. محمد حسين طالب

Pharmaceutics 1

Dr. Mohammed Hussien Taleb

Chapter 1

Pharmaceutical consideration

- **Pharmaceutics** is the discipline of pharmacy that deals with the process of turning a new chemical entity (NCE) or old drugs into a medication to be used safely and effectively by patients.

- It is also called the science of dosage form design. There are many chemicals with pharmacological properties, but need special measures to help them achieve therapeutically relevant amounts at their sites of action.

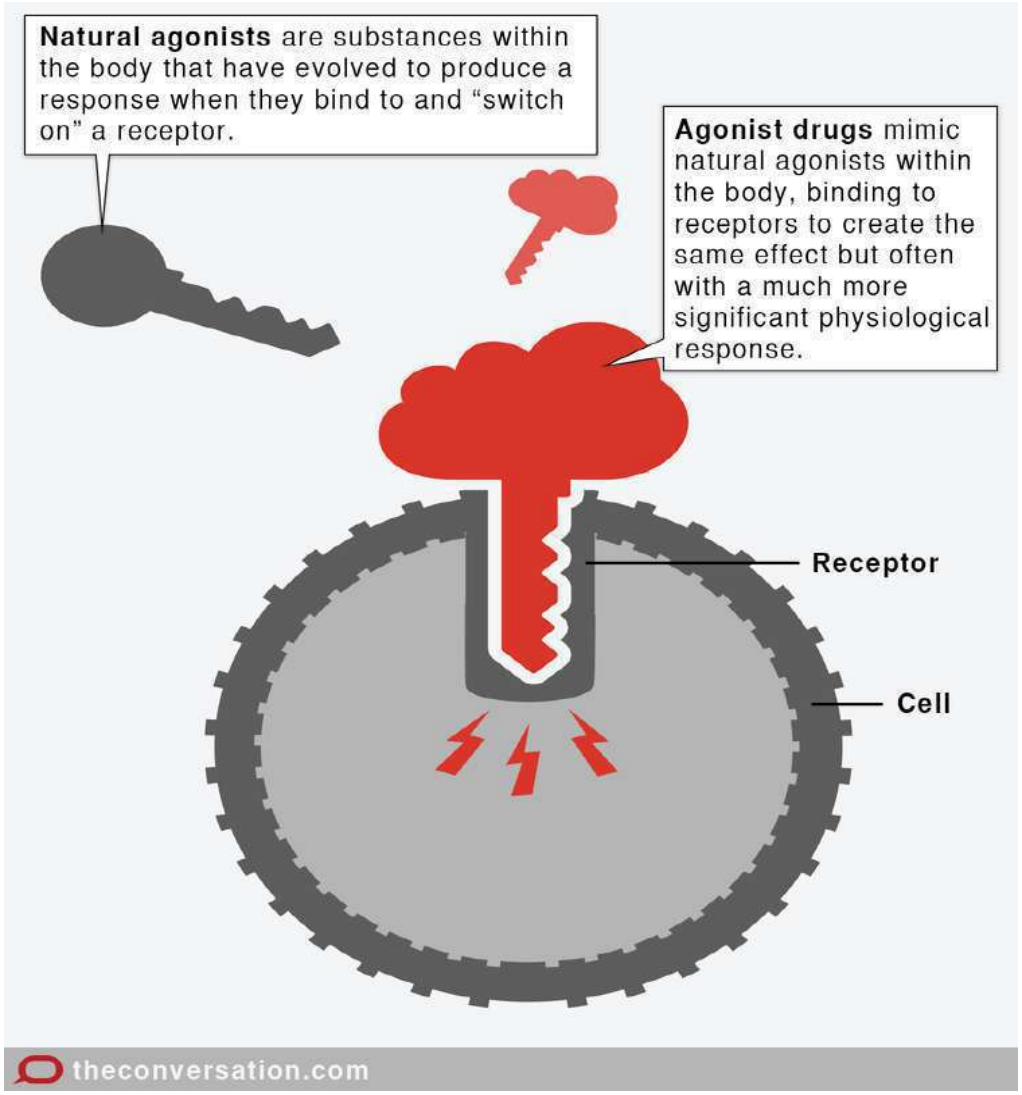
- Pharmaceutics helps relate the formulation of drugs to their delivery and disposition in the body.[1] Pharmaceutics deals with the formulation of a pure drug substance into a dosage form. Branches of pharmaceutics include:
- Pharmaceutical formulation
- Pharmaceutical manufacturing
- Dispensing pharmacy
- Pharmaceutical technology
- Physical pharmacy

- **Pure drug substances** are usually white crystalline or amorphous powders.
- Before the advent of medicine as a science, it was common for pharmacists to dispense drugs as is.
- Most drugs today are administered as parts of a dosage form.
- The clinical performance of drugs depends on their form of presentation to the patient.

Introduction

- The biologic response to a drug is the result of an interaction between the drug substance + functionally important cell receptors or enzyme systems.
- The response is due to an alteration in the biologic processes that were present prior to the drug's administration.
- The magnitude of the response is related to the concentration of the drug achieved at the site of its action.
- This drug concentration depends on
- 1-The dosage of the drug administered,
- 2-The extent of its absorption
- 3-Distribution to the site
- 4-The rate and extent of its elimination from the body.

Cell receptor and drug



- The physical and chemical constitution of the drug substance, particularly its lipid solubility, degree of ionization , and molecular size determines to a great extent its ability to carry out its biologic activity.

- The area of study embracing this relationship between the physical, chemical, and biologic sciences as they apply to drugs, dosage forms, and drug action has been given the descriptive term ***biopharmaceutics.***

- In general, for a drug to exert its biologic effect,
- it must be transported by the body fluids,
- traverse the required biologic membrane barriers,
- escape widespread distribution to unwanted areas,
- endure metabolic attack,
- penetrate in adequate concentration to the sites of action, interact in a specific fashion,
- causing an alteration of cellular function.

- The absorption, distribution , biotransformation (metabolism), and elimination of a drug from the body are dynamic processes that continue from the time a drug is taken until drug has been removed from the body entirely.
- The rates at which these processes occur affect
- The onset,
- Intensity,
- Duration of the drug's activity within the body.

- The area of study that elucidates the time course of drug concentration in the blood and tissues is termed as pharmacokinetics.
- It is the study of the kinetics of absorption, distribution metabolism, and excretion (ADME) of drugs and their corresponding pharmacologic, therapeutic, or toxic effects in animals and man.
- Furthermore, because one drug may alter the ADME of another drug, pharmacokinetics may be applied in the study of interactions between drugs.

- Once a drug is administered and absorption begins, the drug does not remain in a single body location but rather is distributed throughout the body until its ultimate elimination.

- For instance, following the oral administration of a drug and its entry into the gastrointestinal tract, a portion of the drug is absorbed into the circulatory system, from which it is distributed to the various other body fluids, tissues, and organs.

- From these sites the drug may return to the circulatory system and be excreted through the kidney as such or metabolized by the liver or other cellular sites and be excreted as one or more metabolites.

- Drugs administered by intravenous injection are introduced directly into the circulatory system, avoiding absorption, which is required for systemic effects from all other routes of administration.

Pharmaceutics 1

Dr. Mohammed Hussien Taleb

Chapter 1

Pharmaceutical consideration

Lecture 2

Steps involved in the release from a solid dosage form and gastrointestinal absorption of a drug

DOSAGE FORM

Oral administration

Disintegration

Drug in the gastrointestinal tract

Dissolution

Absorption

Drug in blood plasma

Drug bound to plasma proteins

Free drug

Distribution

Drug in the tissues and fluids

Drug in the site of action

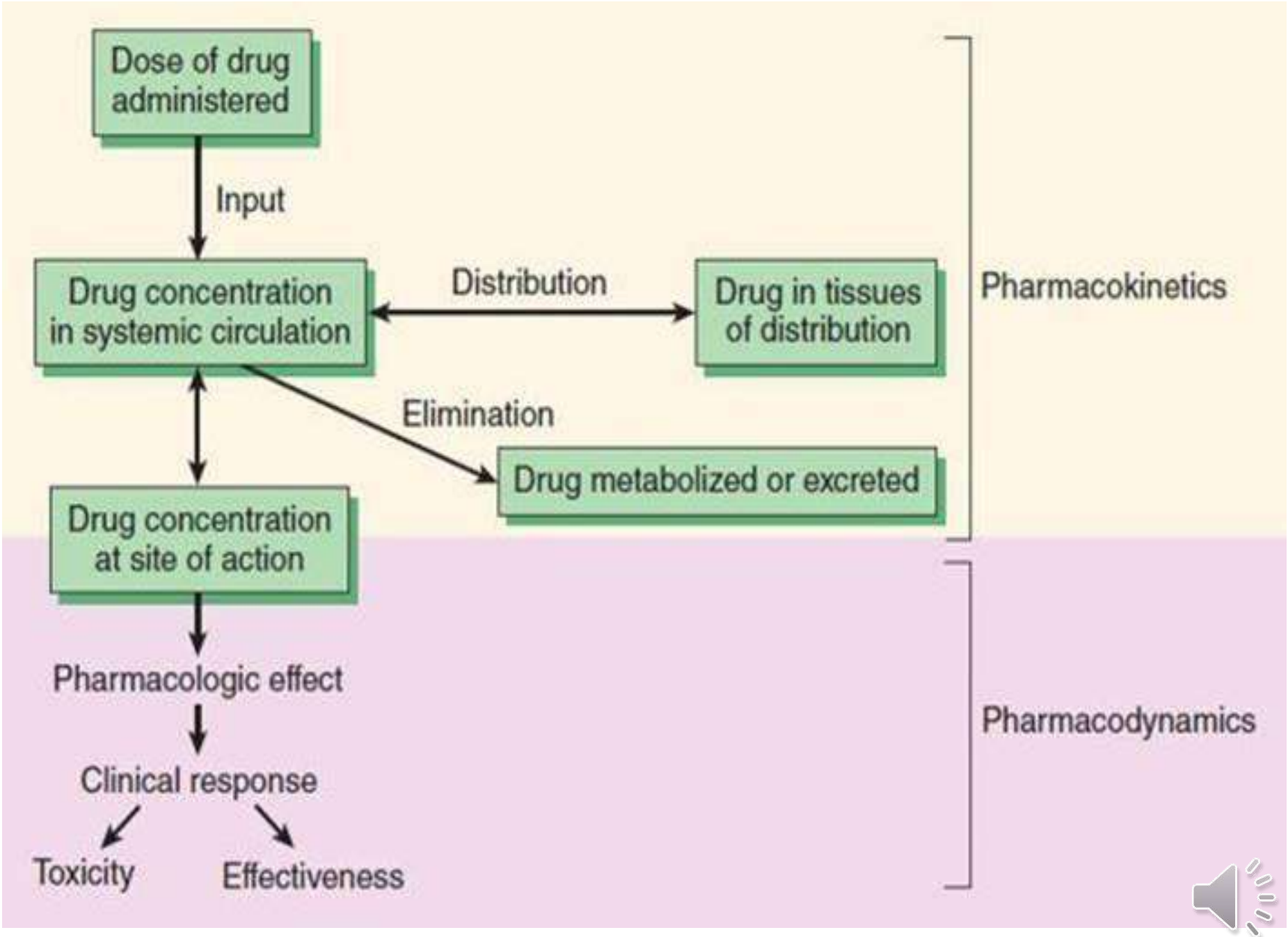
PHARMACOLOGICAL EFFECT

- The various body locations to which a drug travels may be viewed as separate compartments, each containing some fraction of the administered dose of drug.

- The transfer of drug from the blood to other body locations is generally a rapid and reversible process; that is, the drug may diffuse back into the circulation.

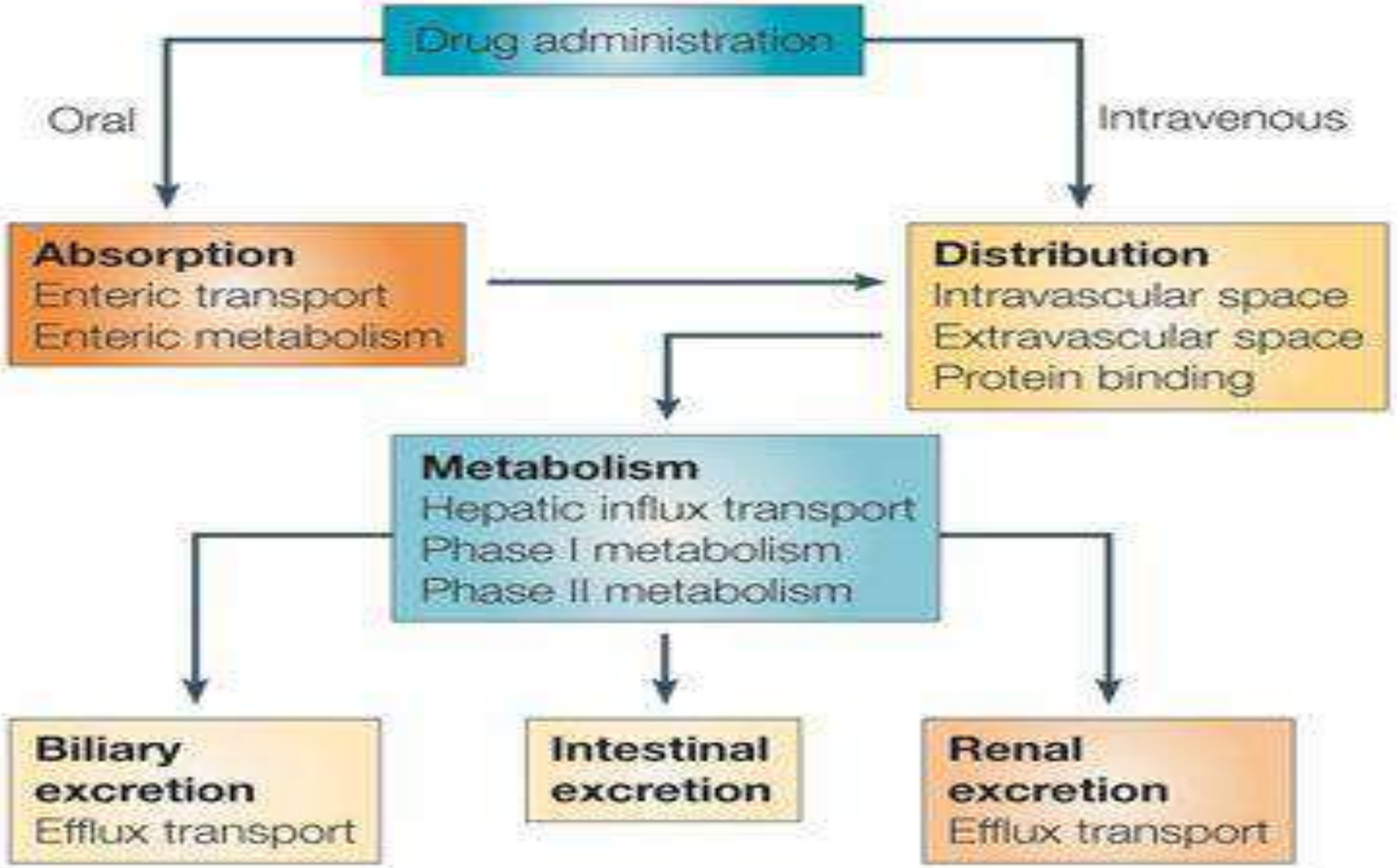
- Therefore exists in equilibrium with the drug in the other compartments. However, in this equilibrium state, the concentration of the drug in the blood may be quite different (greater or lesser) than the concentration of the drug in the other compartments.

- This is due largely to the physicochemical properties of the drug and its resultant ability to leave the blood and traverse the biologic membranes.
- Certain drugs leave the circulatory system rapidly and completely, whereas other drugs do so slowly and with difficulty.

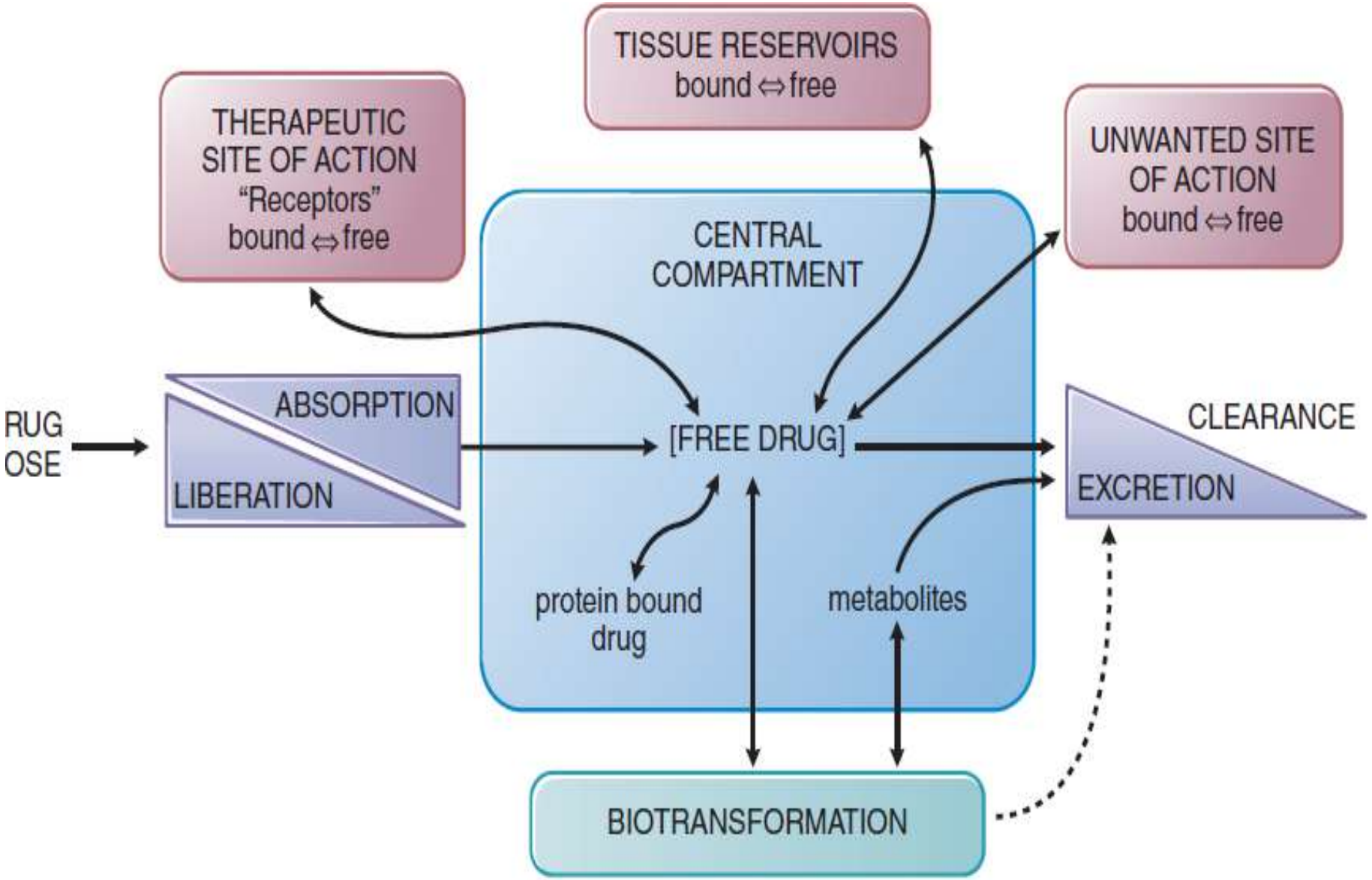

Dose of drug administered
Input
Drug concentration in systemic circulation
Distribution
Drug in tissues of distribution
Elimination
Drug metabolized or excreted
Drug concentration at site of action
Pharmacologic effect
Clinical response
Toxicity
Effectiveness
Pharmacokinetics
Pharmacodynamics

- A number of drugs become bound to blood proteins, particularly the albumins, and only a small fraction of the drug administered may actually be found outside of the circulatory system at a given time.
- The transfer of drug from one compartment to another is mathematically associated with a specific rate constant describing that particular transfer.

- Generally, the rate of transfer of a drug from one compartment to another is proportional to the concentration of the drug in the compartment from which it exits; the greater the concentration, the greater is the amount of drug transfer.



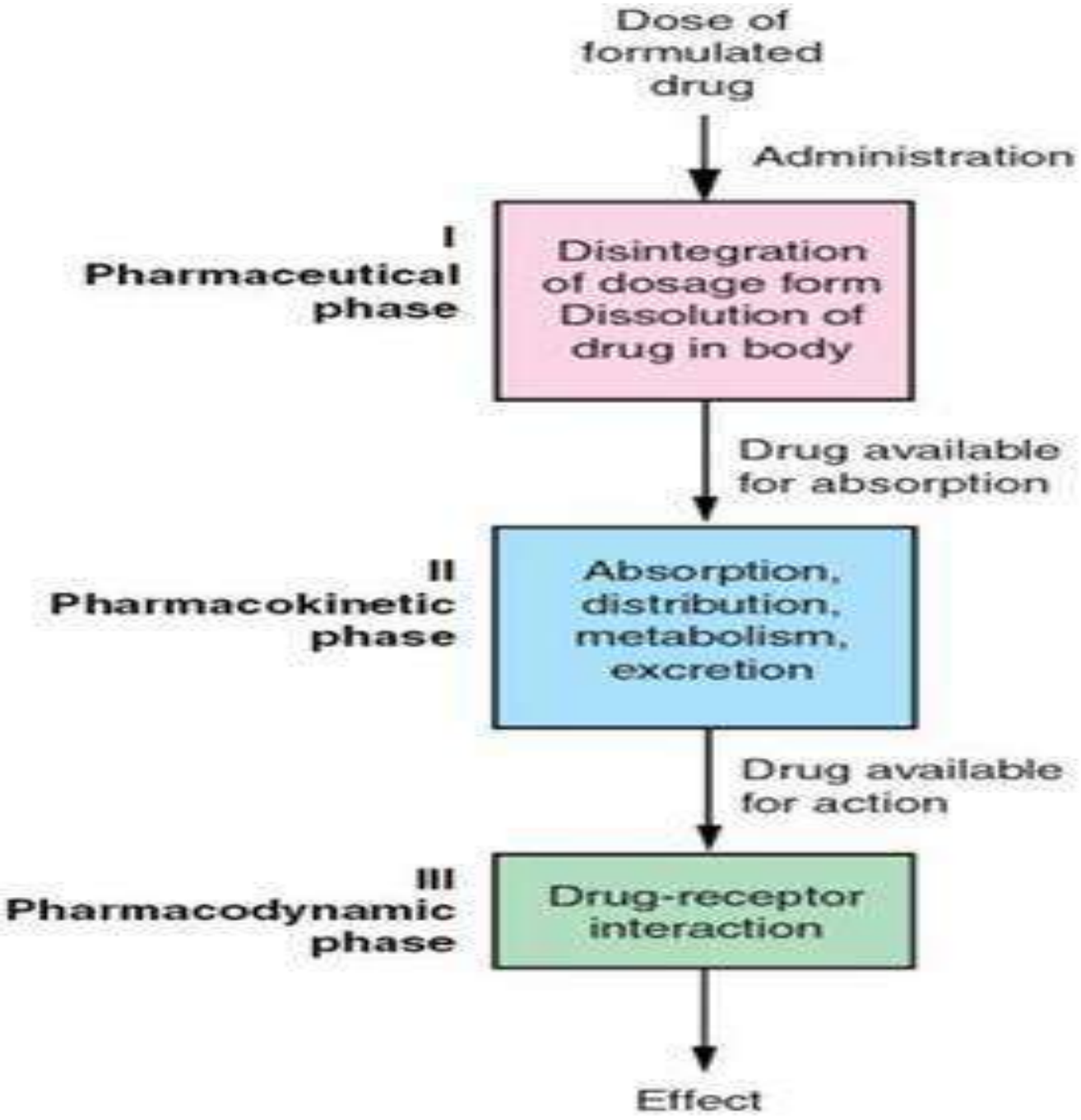
Nature Reviews | Cancer



- **Metabolism** is the major process by which foreign substances, including drugs, are eliminated from the body.
- **During metabolism** a drug substance may be biotransformed into pharmacologically active, inactive metabolites, or both.
- Often, **both the drug substance and its metabolite or metabolites are active and exert pharmacologic effects.**

- For example, the anticonvulsant drug carbamazepine is metabolized in the liver to an active epoxide metabolite.

- In some instances, a pharmacologically inactive drug (termed a *prodrug*) may be administered for the known effects of its active metabolites.


Dose of formulated drug
Administration
I Pharmaceutical phase
Disintegration of dosage form Dissolution of drug in body
Drug available for absorption
II Pharmacokinetic phase
Absorption, distribution, metabolism, excretion
Drug available for action
III Pharmacodynamic phase
Drug-receptor interaction
Effect

- Usually, the metabolism of a drug to inactive products is an irreversible process that culminates in the excretion of the drug from the body, usually via the urine.
- The pharmacokineticist may calculate an elimination rate constant (kel) for a drug to describe its rate of elimination from the body.
- The term elimination refers to both metabolism and excretion.

- For drugs that are administered intravenously and, therefore, are not absorbed, the task is much less complex than for drugs administered by other routes.

TOPICAL

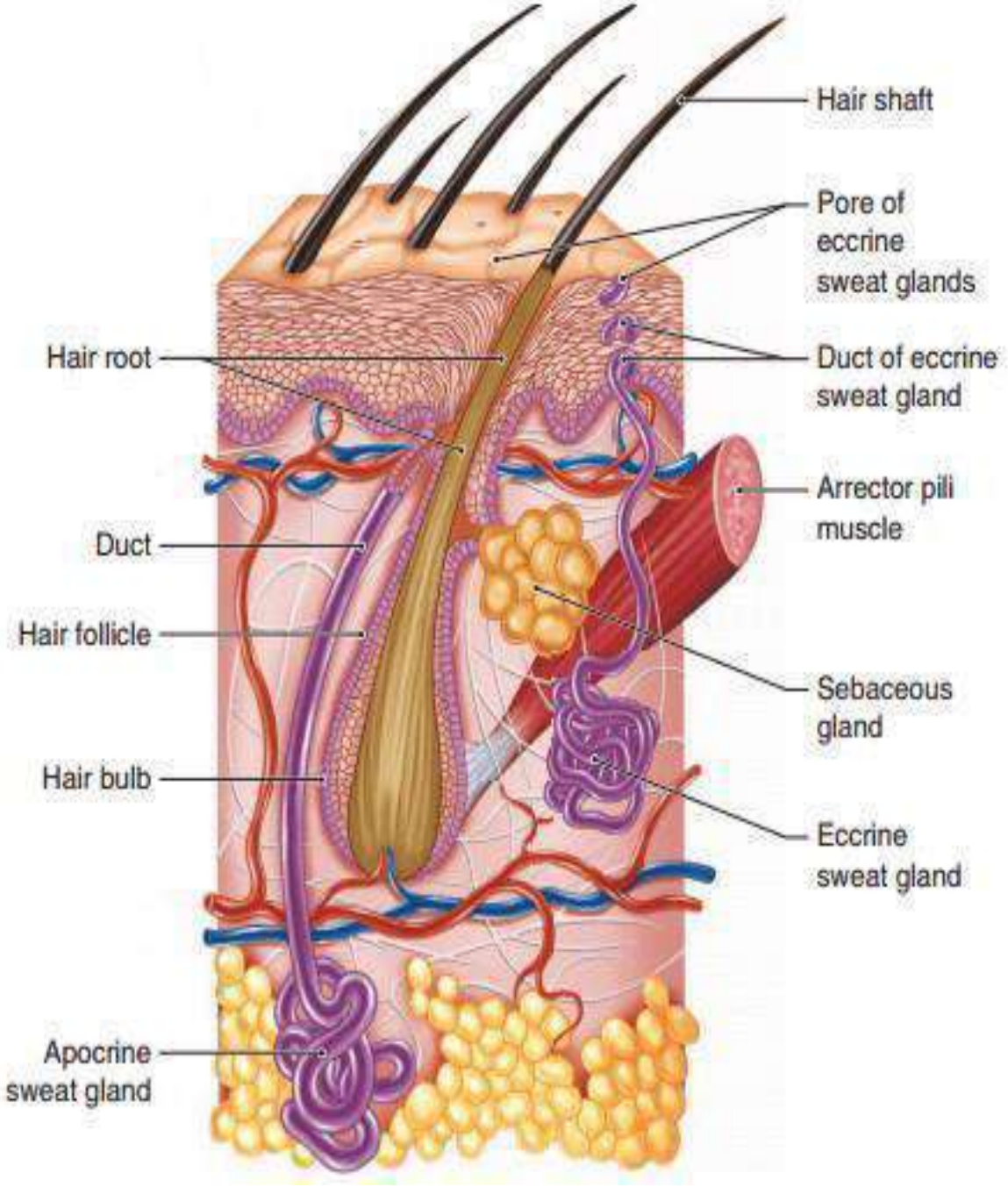
Route of administration

Epicutaneous route

- Drugs are administered topically, or applied to the skin, for their action at the site of application or for systemic drug effects.
- Drug absorption via the skin is enhanced
- 1-if the drug substance is in solution,
- 2-if it has a favorable lipid–water partition coefficient, and
- 3-if it is not an electrolyte.

- Drugs that are absorbed enter the skin by way of the pores, sweat glands, hair follicles, sebaceous glands, and other anatomic structures of the skin's surface.

- Because blood capillaries lie just below the epidermal cells, a drug that penetrates the skin and is able to traverse the capillary wall finds ready access to the general circulation.


Hair shaft
Pore of eccrine sweat glands
Hair root
Duct of eccrine sweat gland
Arrector pili muscle
Duct
Hair follicle
Sebaceous gland
Hair bulb
Eccrine sweat gland
Apocrine sweat gland

Human Skin Diagram