Introduction to Pharmacology

Dr. Alia Shatanawi

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Definitions

Pharmacology:

The science of drugs.

It is the knowledge of history, source, physical and chemical properties, absorption, distribution, excretion, biotransformation, actions and therapeutic uses of drugs. (or toxic effects on microbes and cancer cells)

What is Pharmacology?

Pharmacology is the study of drugs

It involves examining the interactions of chemical substances with living systems, with a view to understanding the properties of drugs and their actions, including the interactions between drug molecules and drug receptors and how these interactions elicit an effect .

Definitions

Drug: It is any chemical that affect living processes. It modifies an already existing function, and does not create a new function.

Definitions

Medical (or Clinical) Pharmacology:

Is the science that deals with the use of drugs for diagnosis, prevention and treatment of human disease.

Definitions

Pharmacy:

Is that branch of the health sciences dealing with the preparation, dispensing, and proper utilization of drugs.

Definitions

Toxicology:

Is that aspect of pharmacology which deals with adverse effects of drugs and the toxic effects produced by household, environmental and industrial chemicals .

Definitions

Clinical Toxicology:

Is the study of the toxic or adverse effects of toxins on the human body, including the diagnosis and treatment of human poisoning.

Analytical toxicology:

Is a branch of analytical chemistry concerned with the measurement of toxic chemicals in biological and environmental materials.

Definitions

Forensic Toxicology:

Deals with the medico-legal aspects of toxicity. It is concerned with proving the relationship of the health condition of the patient (including death) with a particular poison.

Definitions

Environmental toxicology:

- **Deals with the movement of toxins into the environment and contamination of food chain.**
- **Industrial toxicology is a specific area of environmental toxicology that deals with the work environment which is part of industrial hygiene.**

Definitions

- **Two general principles that every student should always remember:**

1. **All substances can under certain conditions be toxic.**
2. **All dietary supplements and all substances promoted as health-enhancing should meet the same standards of efficacy and safety as drugs.**

Terms

- **Prescription:** the written direction for the preparation and the administration of the drug.

- **The therapeutic effect**: is the primary effect intended that is the reason the drug is prescribed such as morphine sulfate is analgesia.

- **Side effect:** secondary effect of the drug is one that unintended, side effects are usually predictable and may be either harmless

Conti…….

- **Drug toxicity:** deleterious effect of the drug on an organism or tissue, result from overdose.

- **Drug interaction:** occur when administration of one drug before or after alter effect of one or both drug.

Conti…….

- **Drug misuse:** Is the improper use of common medications in way that lead to acute and chronic toxicity for example laxative, antacid and vitamins.

- **Drug abuse:** is an inappropriate intake of substance either continually or periodically.

Definitions

Pharmacotherapeutics:

Is the use of drugs in the prevention and treatment of disease (or the medical uses of drugs.(

Chemotherapeutics:

Is the use of drugs to stop the growth or kill microorganisms or cancer cells.

Definitions

Pharmacogenomics:

The relation between the individual's genetic makeup to his/her response to specific drugs (entire genome)

Pharmacogenetics:

Interindividual variation in drug response that is due to genetic influences (specific gene)

Definitions

Idiosyncratic drug response:

Unusual response, infrequently observed in most patients. Usually caused by genetic differences in metabolism of drug, or by immunologic mechanisms including allergic reactions.

Definitions

Tolerance:

Is a decrease in the responsiveness to the drug with continued drug administration.

Tachyphylaxis:

Similar to tolerance but more rapid.

Areas of Pharmacology

Pharmacodynamics:

Is what the drug does to the body, which includes the biochemical and physiological effects of the drug, including the mechanism of action, interaction with receptors as well as the adverse effects.

Areas of Pharmacology

Pharmacokinetics:

- **Is what the body does to the drug.**
- **Deals with absorption, distribution, biotransformation and excretion of drugs:**

1. **Absorption: Is the movement of drug molecules from the site of administration into the circulation.**

Areas of Pharmacology

.2 **Distribution: Is the movement of drug molecules from the circulation to tissues and between different parts of the body.**

3. **Biotransformation: Is conversion of the drug from one chemical structure into another by the action of metabolic enzymes (metabolism.(**
4. **Excretion: Is the movement of drug molecules out of the body.**

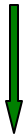
Pharmacokinetics & Pharmacodynamics

Dosage form

Disintegration

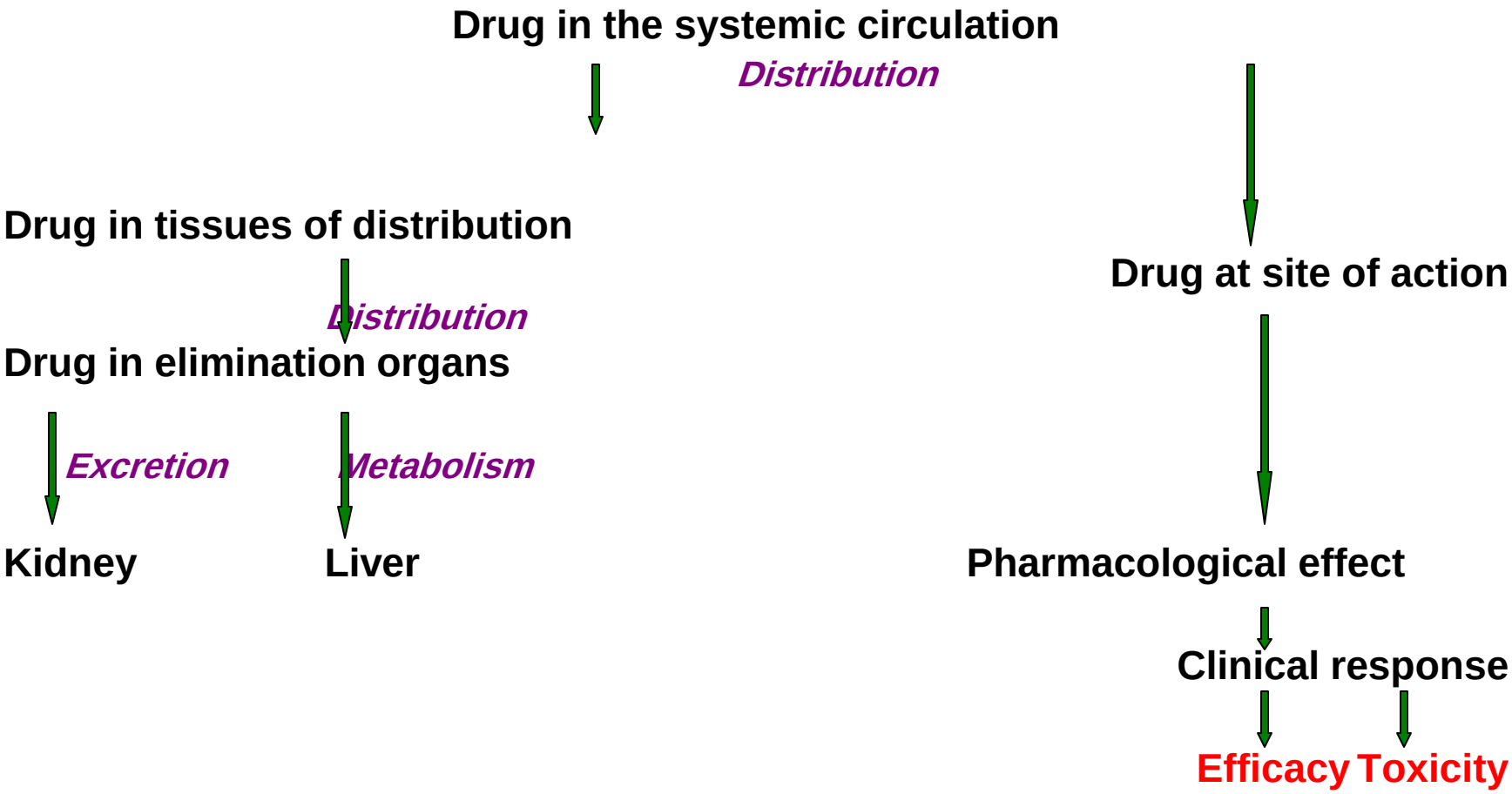
Dissolution

absorption

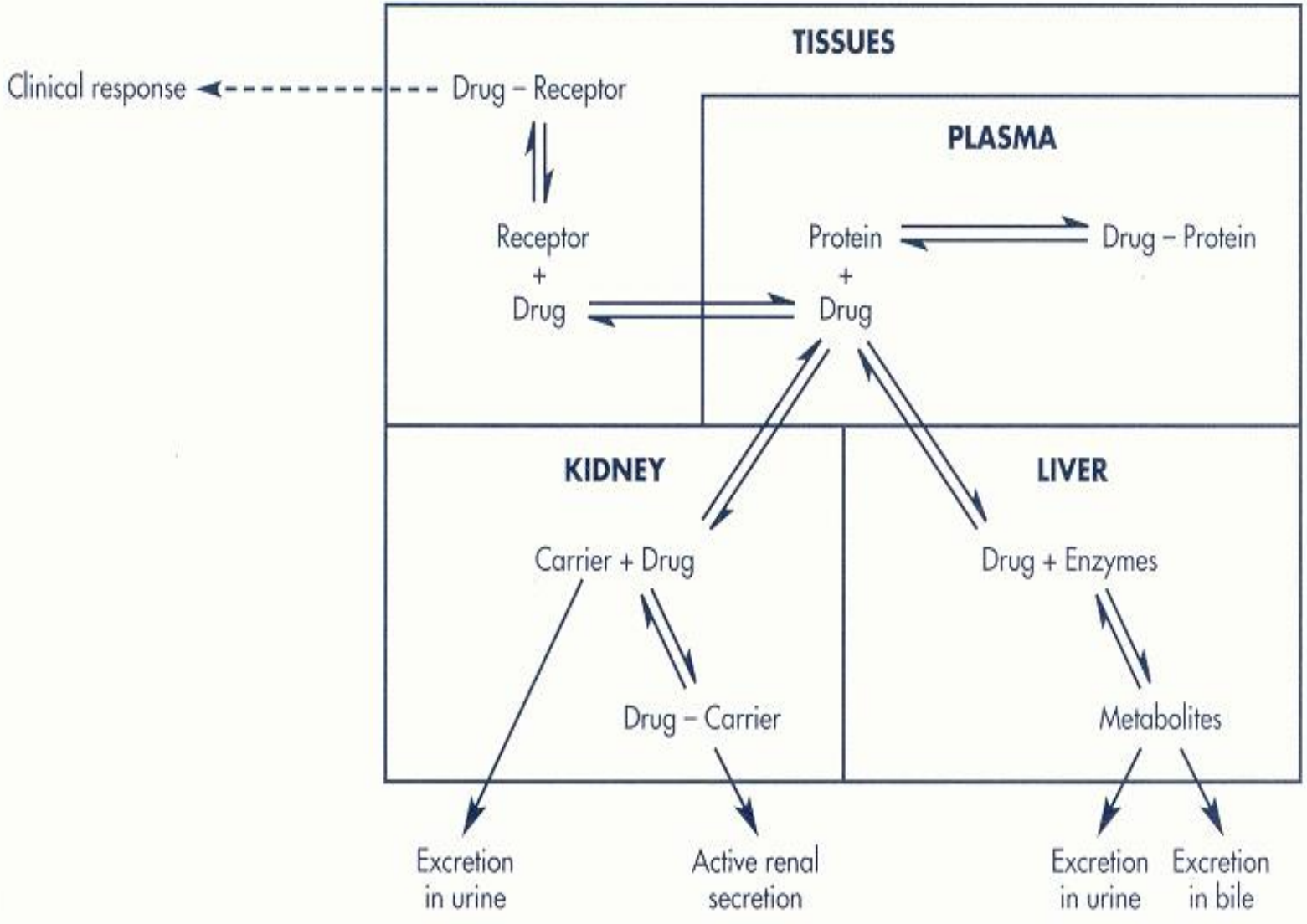


Drug in the systemic circulation

Pharmacokinetics & Pharmacodynamics



Drug Disposition



Drug Sources

1. **Natural Sources:**

- **Plants:** **include alkaloids , which are substances containing nitrogen groups and give an alkaline reaction in aqueous solution. Including morphine, cocaine, atropine, and quinine.**
- **Microbes:** **include antibiotics which are isolated from microorganisms, such as *Penicillium* and *Streptomyces* species .**

Drug Sources

- **Animal tissues:** **The most important are hormones used for replacement therapy (Insulin, growth hormone, thyroid hormones). These days, peptide hormones may by synthesized by recombinent DNA technology.**
- **Minerals:** **include few useful therapeutic agents, including the lithium compounds used to treat bipolar mental illness.**

Drug Sources

.2Synthetic Drugs:

- **Synthesized new compounds:** include aspirin, barbiturates, and local anesthetics which were among the first drugs to be synthesized in the laboratory.
- **Modified naturally occurring drugs:** include Semisynthetic derivatives of naturally occurring compounds, such as the morphine derivative oxycodone.

Drug Sources

- **In some cases, new drug uses were discovered by accident when drugs were used for another purpose, or by actively screening a huge number of related molecules for a specific pharmacologic activity.**

Drug Sources

- **Medicinal chemists now use molecular modeling software to utilize structure-activity relationship, which is the relationship between the drug molecule, its target receptor, and the resulting pharmacologic activity.**

Drugs have been discovered by two approaches

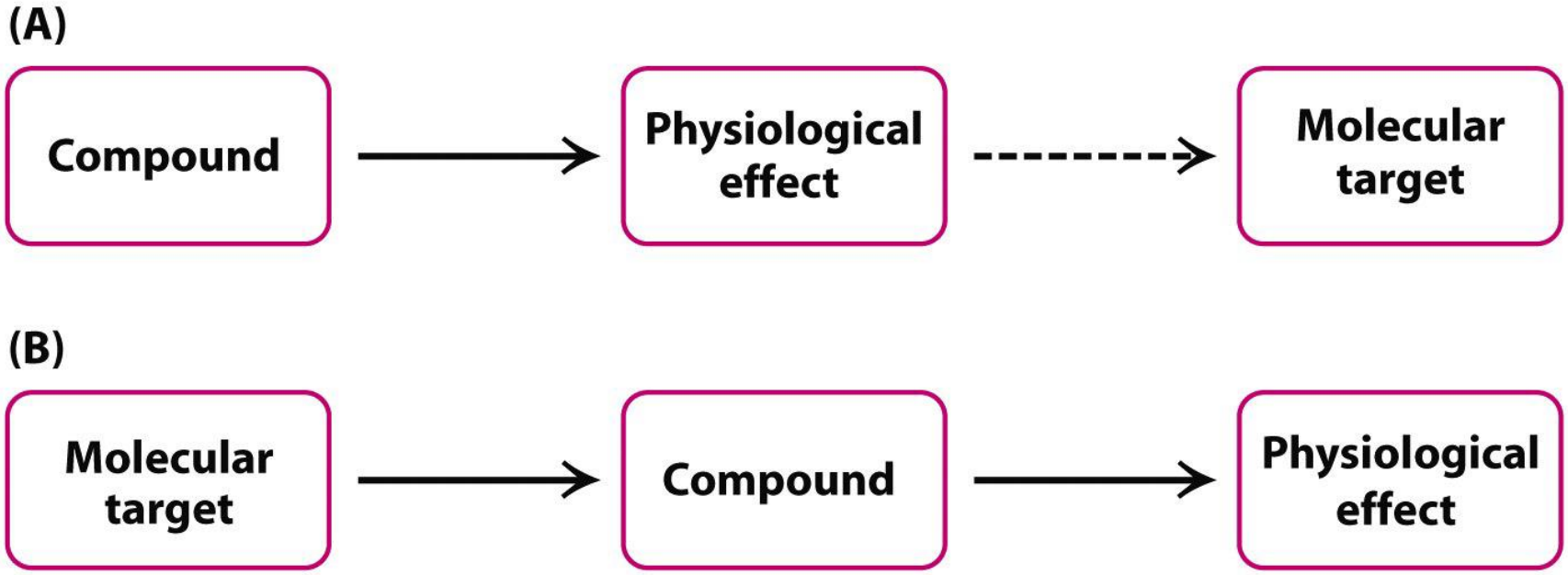


Figure 35-1
Biochemistry, Sixth Edition

Drug discovery phase :

- Serendipity
  - Penicillin
  - Sildenafil
- Screening
  - aspirin
  - Statins/HMG CoA reductase inhibitors
- Design
  - HIV protease inhibitors
  - COX2 specific inhibitors

Naming the drugs

- Chemical name: atomic/molecular structure

- Generic name
  - derived from chemical name
  - listed in US Pharmacopedia & Formulary

- Trade name
  - selected by Manufacturer
  - copyrighted

Drug Names

Chemical Name	*Generic Name*	*Trade Name*
-7chloro-1,3-dihydro-1-methyl-5 phenyl 2H-1, 4-benzodiazepin 2-one	*diazepam*	*Valium*
Ethyl 1-methyl 4-pheyli-sonipecotate hydrochloride	*meperidine*	*Demerol*
acetylsalicyclic	*aspirin*	*Ecotrin*

Phases of Clinical Investigation

TABLE 1.1 Phases of Clinical Investigation

Phase	Purpose
I	Establish safety
II	Establish efficacy and dose
III	Verify efficacy and detect adverse affects
IV	Obtain additional data following approval

Phase I

- When a drug is administered to humans for the first time .
  - Healthy *men* between 18 and 45 years of age
    - Can this be applied to all drugs!!!!?

- The purpose of phase I studies is to establish the dose level at which signs of toxicity first appear.

Phase II

- Phase II: Drugs are given to larger group [100-300] to confirm effectiveness, monitor SE, & further evaluate safety

Phases of Clinical Trials (cont(.

- Phase III: New drug given to even larger group [1,000-3,000] to fulfill all of Phase II objectives & compare it to other commonly used txs & collect data that will allow it to be used safely
- Phase IV: Done after new drug has been marketed - studies continue to test and to collect data about effects in various populations & SE from long term use.

Summary of Phases I-III

	#Subs .	Length	Purpose	%Drugs Successfully Tested
Phase I	100 – 20	Several months	Mainly Safety	%70
Phase II	Up to several 100	Several months- 2 yrs.	Short term safety; mainly effectiveness	%33
Phase III	100s – several 1000	4-1yrs.	Safety, dosage & effectiveness	%30-25

Areas of Pharmacology

- The main areas of pharmacology are :

  A. Pharmacodynamics: the study of the biochemical and physiological effect of the drugs and their mechanism of action .

  B. Pharmacokinetics: the way the body handle drug absorption, distribution, biotransformation, and excretion.