1+2

Pharmacology

Doctor 2018 | Medicine | JU

Sheet ○ Slides

DONE BY

Ameen Alsaras

CONTRIBUTED IN THE SCIENTIFIC CORRECTION

Ibrahim Elhaj

CONTRIBUTED IN THE GRAMMATICAL CORRECTION

Ibrahim Elhaj

DOCTOR

Alia Shatanawi

This sheet is full of definitions. I'll try to make them as brief as possible so please don't get bored

DEFINITIONS: (UNDERSTAND AND DO NOT MEMORIZE)

Drug: Any chemical that affect living processes. It modifies an already existing function. It does NOT create a new function. (For example, analgesics -such as paracetamol- inhibit the synthesis of prostaglandins which is already taking place in the body, thus, killing pain).

Pharmacology: (Pharmacon=drug, logy=study). The study of drugs. It is the knowledge of history, source, physical and chemical properties, absorption, distribution, excretion, biotransformation, actions (how they interact with their receptors or molecules in the body) and therapeutic uses of drugs (toxic effects on microbes and cancer cells).

Medical (Clinical) Pharmacology: Is the science that deals with the use of drugs for diagnosis, prevention and treatment of human disease.

Pharmacy: The science dealing with the preparation, dispensing, and proper utilization of drugs.

Pharmacy ≠ pharmacology

Toxicology: Another branch of pharmacology which deals with adverse effects of drugs and the toxic effects produced by household, environmental and industrial chemicals. E.g: high doses of morphine may cause adverse effects -such as addiction- or even death.

Forensic Toxicology: A branch of toxicology that deals with the medico-legal aspects of toxicity. It is concerned with proving the relationship of illness or death of a patient with a particular poison.

Brainstorming: Poisons are also drugs, why?
-Because poisons are also chemicals that affect processes in our body.

NOTE:

1. All substances can be toxic or harmful under certain conditions.

2. All dietary supplements and all substances promoted as health enhancing should meet the same standards of efficacy(effectiveness) and safety as drugs. So, it must pass drug's study phases that we'll talk about later.

Prescription: The written direction (by a doctor for example) for the preparation and the administration of the drug.

Therapeutic effect	Side effect
the primary effect intended and the reason the drug is prescribed	the secondary effect of the drug and the one that is unintended. Side effects are usually predictable and may be either harmless
Ibuprofen is mainly used for pain killing	Ibuprofen may cause irritation and other stomach problems

Drug toxicity: Deleterious (harmful) effect of the drug on an organism or tissue, resulting from overdose or external use.

Drug interaction: Occurs when administration of one drug before or after another drug alters the effect of one or both drugs.

Drug misuse	Drug abuse
Taking a drug which was not prescribed for other purposes other than what it was made for.	After being prescribed to kill pain for example, it is the inappropriate continuous intake of this drug because of the rewarding effect they give (Addiction)
E.g: using laxatives to get rid of food and lose weight	E.g: Morphine.

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).

For better understanding:
*''**Pharmacogenetics** usually refers to how the variation in one single gene influences the response to a single drug. **Pharmacogenomics** is a broader term, which studies how all genes (the genome) can influence responses to drugs''*

The preceding terms are quite similar and are sometimes used interchangeably. However, what we need to know is their importance. For instance, a mutation in someone's DNA could lead to the absence of a certain enzyme whose job is to get rid of a particular drug. Pharmacogenomics (or -genetics) describes these phenomena and that's why we study it.

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. (unlike 'adverse effects' which are usual and predicted)

Note: Idiosyncratic is not the same word as idiopathic. Idiopathic = of unknown reason.

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

For example: After taking paracetamol for a couple of months, your body will get **used to** it, so you'll need a higher dose every time to get the same effect. Eventually, this drug will become toxic and have many adverse effects -such as liver damage- on your body.

Tachyphylaxis: (Tachy= rapid) Similar to tolerance but happens faster (days instead of months).

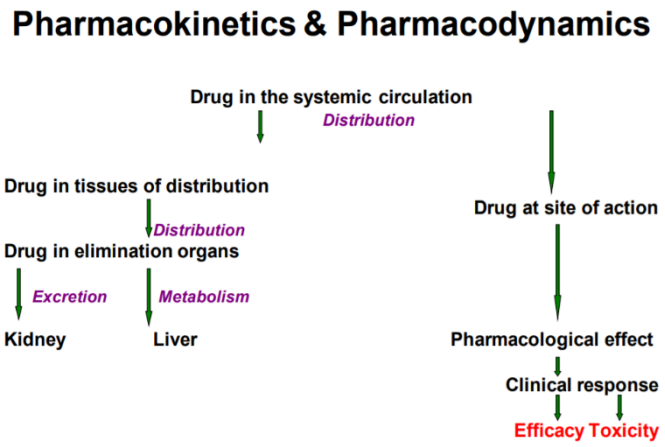
The two main areas of Pharmacology are:

- **Pharmacodynamics:** The study of the biochemical and physiological effect of the drugs and their mechanism of action, (what the drug does to our body).
- **Pharmacokinetics**: The way the body handles drug absorption, distribution, biotransformation, and excretion (What our body does to the drug).

Now let's talk about the story of pharmacokinetics. When the drug gets in our stomach then intestines, it gets absorbed into blood circulation. Secondly, the drug gets distributed, so it moves to different parts and tissues of the body. When the drug arrives to the inflammatory site, pharmacokinetics meets with the pharmacodynamics, and the drug starts its action. After it has finished its work, the drug must be taken care of as we don't want its effect to last forever. One way of doing that is by metabolizing it, which is also called biotransformation (changing it from a chemical form to another to get it out of the body more easily). The drug is now ready to say goodbye and get excreted out.

Brainstorming: Explain why turning the drug into a more hydrophilic form is a major type of biotransformation.
-Most drugs are excreted through urine. As urine is water-based, making drugs more hydrophilic = easier excretion.

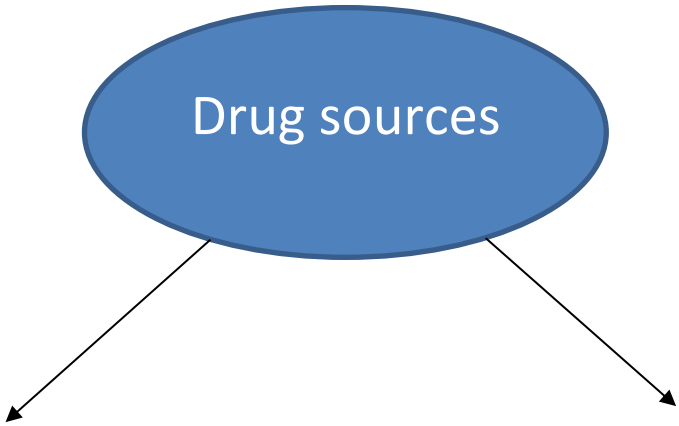
- The figure on the right shows that this process is not sequential. While part of the drug is travelling to the site of action, another part is wandering peacefully in the circulation. A third part is being metabolized and a fourth part is getting out of the body. All at the same time!!



One last definition 😊

Pharmacoepidemiology: The study of the utilization and effects of drugs in large numbers of patients. It looks into the effect of environmental factors on drugs.

Drug Sources:



1.Natural sources:

- **Plants:** include alkaloids (nitrogenic compounds) such as morphine, cocaine, atropine, and quinine.
- **Microbes:** include antibiotics isolated from microorganisms such as penicillium (Fungus) and streptomyces (Bacteria).
- **Animal tissues:** include important hormones such as Insulin (horses), growth hormone, and thyroid hormones. (It is not used anymore, thanks to recombinant DNA technology).
- **Minerals:** such as Lithium compounds which are used to treat mental illness.

2.Synthetic sources:

- **Synthesized new compounds:** include aspirin, barbiturates, and local anesthetics.
- **Modified naturally occurring drugs:** such as chemical changes made to penicillin to make it more absorbable in the GI so it can be given as tablets instead of injection. It also includes oxycodone which is a derivative of morphine and not as strong as it.

Good to know: People with low thyroid hormone (hypothyroidism) used to ingest a thyroid gland from cows or pigs after being dried and crushed to powder.

Naming Drugs:

-Each drug has these three names:

1. Chemical Name: The scientific name that is based on the molecular structure of the drug; the most important example of chemical names is the IUPAC name.

2. Generic Name: Derived from the chemical name and listed in the US Pharmacopedia & Formulary.

3. Trade Name: Selected by the manufacturer. For drugs that make it all the way through development, testing, and final acceptance, the pharmaceutical company then gives the drug a trade name, which is a standard term in the pharmaceutical industry for a brand name or trademark name. It is copyrighted so it can't be used by more than one company.

- The figure on the right shows examples of the three types of names. We only need to memorize the generic name.

Drug Names

Chemical Name	*Generic Name*	*Trade Name*
7-chloro-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→*

Drugs have been discovered by two approaches

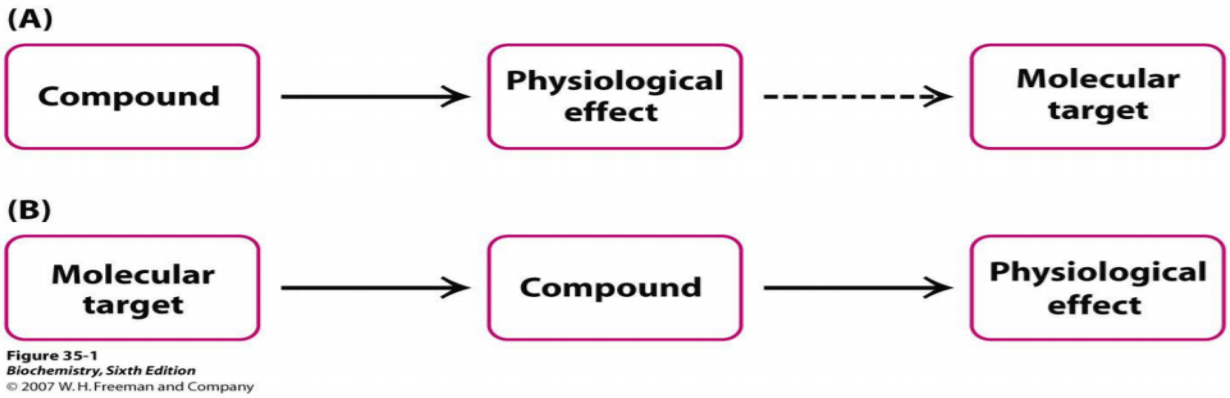


Figure 35-1
Biochemistry, Sixth Edition

(A): As in penicillin, we discover a drug by accident. We observed that a compound has a certain physiological effect (killing bacteria) without knowing the mechanism of action. After several years the mechanism was discovered and so we started using penicillin to target a molecule inside bacteria (cell wall) to treat patients.

(B): We start by analysing the problem and finding out the molecule (enzyme for example) which is behind it. Then we go to a chemist to prepare 500-1000 compounds that can inhibit that enzyme. Now we start experimenting each one in a test tube to see if we get our desired physiological effect. If we find our promising compound, we put it in further studies in cell culture then in animals to check for the effect in living cells, guarantee that it's not toxic, and choose the best dose to use.

***This topic will be covered in more details in the next sheet**

Good Luck!!