Chapter-1

INTRODUCTION TO NURSING PHARMACOLOGY

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PHARMACOLOGY BASICS

- The word pharmacology is derived from two Greek words: *pharmakon*, which means "medicine, drug," and *logos*, which means "study."

Pharmacology = medicine + study

- **Pharmacology:** is the scientific study of the origin, nature, chemistry, effects, and uses of drugs.

1 2 3 4 5

- **Drug:** is a chemical agent capable of producing biological responses within the body. These responses may be desirable (therapeutic) or undesirable (adverse).

الدواء هو مادة قادرة على إعطاء استجابة حيوية ← مرغوب بها / غير مرغوب بها

- **Toxicology:** is the study and characterization of the adverse effects caused by excessively high concentrations of drug in the body and the harmful, potentially fatal results that may result.

التعريف ناقص / المفروض يكون:
deals with toxins, poisons, effects and ttx.

1

Nursing Considerations

- ***Toxic effects*** should not be confused with ***adverse or side effects***.

= Toxicity

Toxic Effects ≠ Adverse Effects (Side effects)

- too much drug
- (overdose)

- drug conc. are within therapeutic level
- But ! drug interacts with sites other than target site → unwanted, not fatal effects

- Side effects (and adverse effects) occur when drug concentrations are within therapeutic levels, as a result of that drug's interaction with sites other than the drug's target site, producing unwanted, but not fatal, effects.

- **Toxicity** is a result of "too much drug" in the body, when the amount of drug present in the body exceeds the "dose"; hence the derivation of the term overdose.

- **Drug Names:**

= official name
= Approved name

= non proprietary (غير ملكي)
Proprietary (ملكي)

Every drug has (at least) three names: (1) a chemical name, (2) a generic name, and (3) a brand name there can be one or more proprietary or trade names).

The *chemical name*: is a scientific name that precisely describes the drug's atomic and molecular structure.

الاسم علمي يصف التركيب الذري والجزيئي

The *generic*: or *nonproprietary, name* (Also called approved name & official name and is not protected by trademark).

It is an abbreviation of the chemical name determined by the pharmaceutical company along with a special organization known as the U.S. Adopted Names Council (USAN).

USAN + الدوائية

- ✓ الاسم غير ملكي
- ✓ متفق عليه وعلمي
- ✓ لا يصاحبه علامة تجارية
- ✓ اختصار للاسم العلمي
- ✓ يحدد عن طريق الشركة المصنعة

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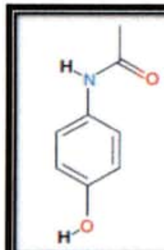
- **The *trade name*:** (also known as the *brand name* or *proprietary name*) is selected by the drug company selling the product.

✱ The symbol ® after a trade name indicates that the name is registered by and restricted to the drug manufacturer.



Chemical name: *N*-acetyl-*p*-aminophenol

Generic name: acetaminophen
(common acronym: "APAP")

Brand name: Tylenol®, manufactured by McNeil

Prescription and Nonprescription Drugs

- There are two ways to legally access drugs.
- One is to obtain a *prescription* for the drug from a licensed provider by a physician.
- The other is to purchase drugs that do *not* require a prescription on an ***over-the-counter*** *(OTC)* basis.

Controlled Substances

- The Comprehensive Drug Abuse Prevention and Control Act was passed in 1970 and regulates the manufacturing and distribution of substances with a potential for abuse— examples include narcotics, hallucinogens, stimulants and depressants.
- These **controlled substances** are categorized by schedule (Schedules I–V), based on their therapeutic use and potential for abuse.

Classifying drugs:

- Drugs that share similar characteristics are grouped together as a ***pharmacologic class*** (or family). For example: Beta-adrenergic blockers are an example of a pharmacologic class.
- A second type of drug grouping is the ***therapeutic class***, which categorizes drugs by therapeutic use. Antihypertensives are an example of a therapeutic class.

كيف يمكن تصنيف الأدوية؟

على حسب المجموعة الدوائية (العمل الدوائي) — مثلاً/ BB

على حسب المجموعة العلاجية (الغرض العلاجي) — مثلاً/ معالجات ارتفاع ضغط الدم، معالجات سكر الدم

Source of drugs:

1. **Plants**

e.g. Morphine from Opium poppy.

Atropine from Belladonna leaves.

Quinine from Cinchona bark

2. **Animals** – e.g. Heparin, Insulin and Thyroxin from different animals (horses – Pigs)

3. Microorganisms:

e.g. Penicillin from Penicillium notatum

Streptomycin from Streptomyces griseus

Bacitracin from Bacillus subtilis

4. Minerals

e.g. Calcium, Magnesium, Aluminium, Sodium, Potassium, Iron salts

5. Bio-Synthetic Drugs أدوية صناعية حيوية

These are prepared by cloning of human DNA into bacteria like E.Coli.

Technique is called Recombinant DNA technology or Genetic Engineering

e.g. Human Insulins, Human Growth Hormones (Somatrem, Somatropin)

نستخدم البكتيريا علشان نصنع أدوية باستخدام تقنية «الهندسة الوراثية»

6. *Synthetic* drug sources:

They are prepared by chemical synthesis in pharmaceutical laboratories.

e.g. Sulphonamides, Salicylates, Barbiturates, Benzodiazepines etc.

7. Semi-Synthetic Drugs:

These are prepared by chemical modification of natural drugs in labs.

e.g. Ampicillin from Penicillin-G.

Dihydroergotamine from Ergotamine.

Note:

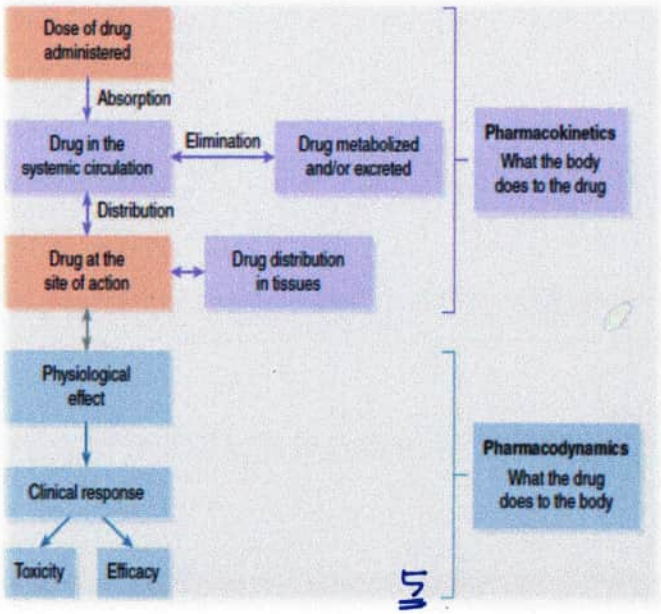
- One advantage of chemically developed drugs is that they're free from the impurities found in natural substances.

→ **Pharmacovigilance:**

The science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other medicine/vaccine related problem.

Three basic concepts of pharmacology:

- → **Pharmacokinetics:**
- The absorption, distribution, metabolism, and excretion of drugs by the body
- → **Pharmacodynamics:**
- The biochemical and physical effects of drugs and the mechanisms of drug actions
- → **Pharmacotherapeutics:**
- The use of drugs to prevent, treat and diagnose diseases.



PHARMACOKINETICS

تأثير الجسم على الدواء

A D M E

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- Pharmacokinetics refers to what the body does to a drug.

- Four pharmacokinetic properties determine the onset, intensity, and duration of drug action :

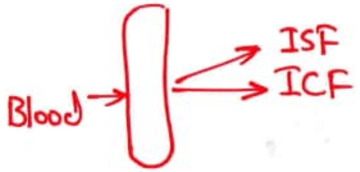
1. Absorption:

- First, absorption from the site of administration permits entry of the drug (either directly or indirectly) into plasma.

- **Note** : The rate and extent of absorption depend on the environment where the drug is absorbed, chemical characteristics of the drug, dosage form, and route of administration (which influences bioavailability).

* Rate of Absorption
* Extent of =
depend on → enviroment of drug absorption
→ chemical characteristis of drug
→ drug dosage form
→ ROA
↳ influences Bioavailability ..

2. Distribution:



- Second, the drug may reversibly leave the bloodstream and distribute into the interstitial and intracellular fluids.

3. Metabolism: = Biotransformation — الطحال liver

- Third, the drug may be biotransformed through metabolism by the liver or other tissues.

4. Elimination: = Excretion

- Finally, the drug and its metabolites are eliminated from the body in urine, bile, or feces.

- Using knowledge of pharmacokinetic parameters, clinicians can design optimal drug regimens, including the route of administration, dose, frequency, and duration of treatment.

ماذا تفيد المعرفة بالـ PK ؟!

PHARMACODYNAMICS:

تأثير الدواء على الجسم - MOA

- Pharmacodynamics describes what the drug does to the body. - Reacting with Receptors.
- Pharmacodynamics describes qualitatively the therapeutic activity of a drug once it is in the bloodstream and characterizes the interaction of the drug with its target site, known as the mechanism of action (MOA).
- Most drugs exert effects, both beneficial and harmful, by interacting with specialized target macromolecules called *receptors*.

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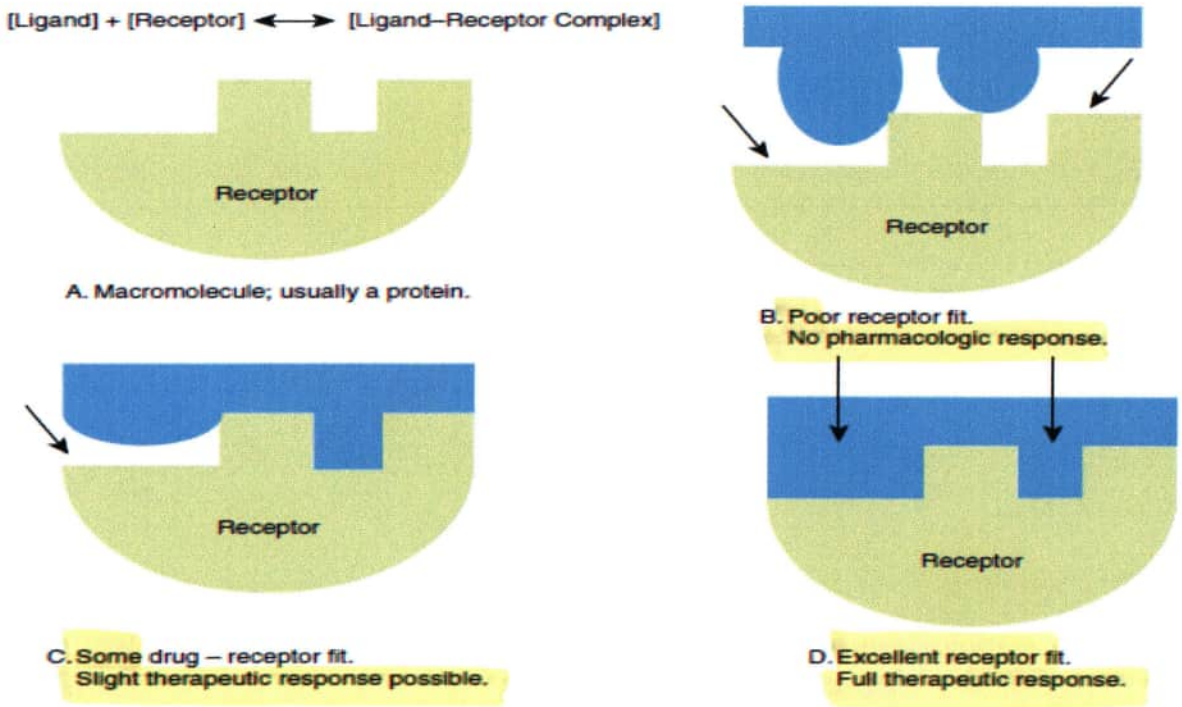
- **Receptors:** are large protein molecules located either outside the target cell called *extracellular* receptors, or inside the cell, called *intracellular* receptors.
- Most receptors have specific, naturally-occurring (**endogenous**) compounds called **ligands**. ← هم المركب الذي يتفاعل مع الـ R
- When the proper ligand binds to its receptor, it causes a stimulation (or *activation*) of the receptor molecule, which leads to a biological response.

Ligand + Receptor → Stimulation / activation of Receptor → Biological Response.



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- The drug–receptor complex initiates alterations in biochemical and/or molecular activity of a cell by a process called signal transduction.

تعريف Signal Transduction :-
alterations in biochemical or Molecular activity .. due to drug-receptor complex.

- On the target site, a drug molecule is expected to exhibit its mechanism of action.
- The principles based on which the drug elicit such action can be broadly classified into the following types:

أنواع عمل الدواء

1-activation
2- inhibition
3- complexation
4- Neutralization

1. Activation:

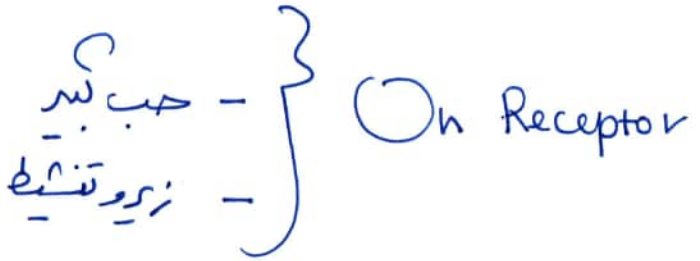
- By binding to the target site if the drug molecule stimulates the process or selectively accelerates the process.

- **Agonists:** molecules that activate receptors

  Has high affinity and high intrinsic activity (binds and activates receptor)

2. Inhibition:

- On the target site a drug molecule exhibiting its action by inhibiting the process or selectively deaccelerating the process.
- **Antagonist:** molecules that produce effects by preventing receptor activation by endogenous regulatory molecules. The molecule has high affinity for receptor but no intrinsic activity (binds to receptor but does not activate receptor



3. Complexation:

- On the target site, the drug molecule exhibiting its action by making a complex, thereby making it inactive by sequesterization. ✓ For example, deferoxamine chelates iron and EDTA with Calcium.

→ b/w drug and target

4. Neutralization:

- The drug molecule binding to the target site and neutralizing the action of the existing molecule directly through a chemical reaction [for example, antacids (sodium bicarbonate, magnesium hydroxide)] or physical interaction (polyvalent anti snake venom).

How neutralization occurs?

- Chemically
  - antacids to relieve gastritis
- Physically.
  - PV anti snake venom (Ab)

PHARMACOTHERAPEUTICS

- Pharmacotherapeutics is the use of drugs to treat disease.
- When choosing a drug to treat a particular condition, health care providers consider the drug's effectiveness as well as such factors as the type of therapy the patient will receive.

قراءة

- **Types of drug therapies**
- **Acute therapy:** drugs are used to sustain life or treat disease – stroke, heart attack.
- **Maintenance therapy:** drugs are used to prevent the progression of chronic diseases, such as hypertension, hyperlipidemia.

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- **Supplemental/replacement therapy:** drugs supply substances not available to the body, such as insulin for diabetic clients, iron.

مكملات / بدائل نواقص

- **Palliative therapy:** Drugs used to maintain comfort - high dose opioids for cancer patients.

المريض المصاب بمرض خطير
تحسين جودة حياة

- **Supportive therapy:** drug therapy that help to maintain body functions - fluid and electrolytes

علاج داعم للصحة

- **Prophylactic therapy:** drugs help to prevent illness and have scientific evidence to support their use – antibiotics before surgery.

وقائي

- **Empiric therapy:** drugs are used based on past experience with their actions rather than scientific evidence.

علاج أولي .. قبل إكمال الفحوصات

OVERVIEW OF NURSING PROCESS

- The nursing process is a systematic, rational, and continuous method of planning, providing, and evaluating individualized nursing care to optimize the administration of medications.

- The nursing process involves critical thinking throughout each of its five steps:

1. Assessment:

- involves collecting subjective and objective data from the patient, significant others, medical records (including laboratory and diagnostic tests) and others involved in the patient's care.

Medication history:

- Prescriptions/OTC drugs
- Herbal supplements
- Response to medications
- Knowledge of medications
- Medication adherence

2. Nursing diagnosis:

- second step of the nursing process involves clustering the data gathered during the assessment, analyzing it for patterns, and making inferences about the patient's potential or actual problems.

- Some examples of selected diagnoses follow:
  - ➔ Patient is at risk for injury related to adverse effects of medication.
  - ➔ Diarrhea (or constipation) related to side effects of medications.

3. Planning and Establishing goals or outcomes

- During this phase, **goals** and outcome criteria are formulated.
- For example, the patient may be expected to and agree to do the following: List the steps for correctly drawing up his or her insulin dosage.

4. Intervention or Implementation

- The implementation phase is when you put your care plan into action.
- For example, perhaps a patient has a laxative ordered daily but has been having loose stools all night.

The nurse will need to assess this patient's current condition (i.e., complaint of loose stools) and decide how to proceed with the intervention (e.g., withhold the medication and notify the prescriber)

5. Evaluation

- The evaluation phase of the nursing process is a continuous process of determining progress toward identified goals.
- For some medications, the response can be identified quickly—for example, relief of pain following administration of an analgesic.

- **Monitor patient's response to medication.**
- **Monitor for possible adverse effects of medication.**
- **Monitor for unexpected effects of medication.**
- **Document medication administration.**

NURSE'S 'FIVE RIGHTS OF DRUG ADMINISTRATION'

- Use the RIGHT drug
- Give to the RIGHT patient
- Give the RIGHT dose
- Give by the RIGHT route
- Give at the RIGHT time
- Must also be ready to respond to interaction between drug and patient (i.e., must be aware of drug REACTIONS and SIDE EFFECTS)

الأمور التي أدم نراعيها
عند إعطاء الدواء