1 Drugs

Drug: Chemical that affects how the body works
Medicine: a substance that improves health
Medicine are drugs, but ***not all drugs*** *are medicine* aka $Medicine \subset Drugs$

2 Drug Adinistration

The five main methods of drug delivery

- Oral: By mouth

  convenient for the patient, slow onset

  drugs like insulin can be destroyed by enzyme

- Inhalation: Inhaling gases

  fast onset

  direct treatment of lung disease

- Rectal: Introducing drugs into the rectum

  for unconcious or vomitting patient

  can have local effect of enter the bloodstream

- Topical(Trans-dermal): Diffusion through the skin

  Mostly local effect (e.g lotion), sometimes has access to blood circulation (e.g containing nicotine)

- Parenteral (Injection)

  1. Intravenous: Most used, directly through the bloodstream
  2. Subcutaneous: Directly under the skin
  3. Intramuscular: Directed into skeletal muscle

3 Drug Dose

3.1 Physiological Effects

Therapeutic Effect: a desirable and beneficial effect; it alleviates symptoms or treats a particular disease. (**The intended**)

Side Effect: an unintended secondary effect of the drug on the body; it is usually an undesirable effect. For example, morphine is a strong analgesic used to treat pain, but in some patients it can cause constipation, nausea and vomiting. (**The unintended**)

3.2 Addiction = Dependence

- Physiological Dependence
- Psychological Dependence

3.3 Dosage and Dosage Regimen

Dose: amount of drug administered
Dosage Regimen: Amount of drug administered at one time, and frequency administration.

3.4 Therapeutic Index and Therapeutic Window

3.4.1 Therapeutic Window

the range of dosage between the minimum required to cause a therapeutic effect and the level which produces unacceptable toxic effects.

3.4.2 Therapeutic Index(TI)

Expression of Toxicity for Animals: LD_{50}
LD_{50}: Lethal Dose, the dose of the drug required to kill **50 percent** of the animals tested

Expression of Toxicity for Humans: TD_{50}
TD_{50}:Toxic Dose, the dose required to produce a toxic effect in 50 percent of the test population
ED_{50}: Effective Dose, the dose required to produce a therapeutic effect in 50 percent of the test population

$$TI = \frac{LD_{50}}{ED_{50}} \text{ or } TI = \frac{TD_{50}}{ED_{50}}$$

3.4.3 Placebo Effects

It is found that some people who take the placebo do feel better, even though it contains only inactive ingredients. This is known as the placebo effect.

3.5 Tolerance

occurs when the body becomes less responsive to the effects of a drug, and so larger and larger doses are needed to produce the same effect. This means that the patient may be at higher risk of toxic side effects.

4 Drug Development (Design)

Overall Stage of Drug Development:

1. Identification of Lead Compounds
2. Animal Tests
3. Clinical Trials

4.1 Identification of Lead Compounds

1. Isolation from the natural resources
2. Chemical Synthesis
3. Searching through existing 'banks' of compounds already synthesised

4.2 Clinical Trials

Phase I: Healthy Volunteers to determine **Therapeutical Effects** and **Side Effects**
Phase II: Volunteer Patients
Phase III: compares its activity with existing drug treatments or placebos
For doctors and patients, they cannot tell the placebo effects, so it's a **double-blind** process.

5 Bioavailability

Definition: the fraction of the administered dosage that reaches the target part of the human body

5.1 Bioavailability depends on medical administration

- **intravenous injection**: 100%
- oral: $< 100\%$

  largely depending on solubility $\rightarrow$ structures

  - with polar bonds (OH groups)
  - Functional Group (ionisation, COOH and NH_2)

6 Drug-Receptor Interactions

Drug–receptor interactions are based on the structure of the drug and the site of activity.