Concepts and Terminology

Toxicology: is the study of poisons, it includes the identification of poisons, their chemical properties, and their biological effects as well as the diagnosis and treatment of disease conditions that they cause.

* Pharmacology and toxicology shared many common principles, including Biodynamics of uptake and elimination , mechanism of action,principles of treatment and dose-response relationships.

* Therapeutic drugs and essential nutrients can become poisoned under certain conditions.

DEFINITIONS:-

- A poison: is any solid, liquid, or gas that interferes with the life processes of cells of the organism,

- Toxicant: An alternative term for poison.

- Toxin. A poison that originates from biological processes; also called a *biotoxin*. Mycotoxins (fungal toxins) and zootoxins (toxins of lower animals, e.g. snake venom) Phytotoxins (plant toxins) are common examples of biotoxins.

- The term toxic used to describe the effects of a poison on living systems.

- Xenobiotics: is the general term that is used for a foreign substance taken into the body. It's derived from the Greek term (Xeno) which means foreigner or stranger. Xenobiotic may be produced:

- Beneficial effects (as medicines)

- Or they may be toxic (as lead)

- *Toxicity.* The quantity or amount of a poison that causes a toxic effect. Toxicity is usually expressed as milligrams of toxicant per kilogram of body weight that will produces a defined biologic effect.

- *Dose*. The total amount of toxicant received per animal.

- *Dosage*. The amount of toxicant per unit of animal mass or weight. It can also be expressed as the amount of toxicant per unit of mass or weight per unit of time. For instance, a dog could

receive a dosage of chemical at the rate of 2 mg/kg/day.When conducting traditional acute, subacute, subchronic, or chronic studies, the length and frequency of exposure are also noted. For instance, rats may receive a chemical dosage of 2.5 mg/kg/day for 2 years.

 Toxicosis. A disease state that results from exposure to a poison.the term toxicosis is often used interchangeable with the terms poisoning and intoxication.

 Route of exposure. The route of exposure is an important component of assessing the toxicity of a chemical or drug. The most common routes of exposure are inhalation, oral, and dermal, with some variations for each. . Less frequently routes of exposure include rectal, sublingual, subcutaneous, and intramuscular.

 Threshold dose. The highest dose of a toxicant at which toxic effects are not observed.

 Lethal dose (LD). Is the lowest dose of compound that causes death.

 Lethal dose 50 or LD50 : the dose at which 50% of the animals die during some period of observation. LD can also be expressed as other percentages such as LD10 (**dose at which 10% lethality occurs in test animals**) or LD90 **(dose at which 90% lethality occurs in test animals).**

 Median lethal dose (MLD) ; a term used interchangeably with the LD50.

 The lethal concentration : is the lowest concentration of a chemical or drug (in feed or water) that causes death.

 The effective dose: is the dose of drug or toxicant that produces desired effect in a population

. *Expressions of safety for drugs :*

_ *Therapeutic index (TI).*is defined by the ratio of the LD50 to the Ed50.

(TI) = LD50/ED50, the TI is a unitless estimate that characterizes the relative safety of a drug or chemical. The larger the TI, the more "safe" a chemical is relative to another with a smaller TI. For example, if chemical X has an LD50 of 1000 mg/kg and an ED50 of 10 mg/kg, the TI would be 100 (the mg/kg units cancel). Compare this to chemical Y, which has an LD50 of 50 mg/kg and an ED50 of 40 mg/kg. The TI of chemical Y is 1.25, a much less safe chemical when compared with chemical X.

_ *Standard safety margin (SSM)* or *margin of safety (MoS).* Is defined by the ratio of the LD1 to the ED 99 .

SSM = LD1/ED99, the SSM, like the TI, is a unitless estimate that characterizes the relative safety of a drug or chemical, but much more conservative data are used. The larger the SSM, the more safe the chemical tends to be relative to other chemicals with smaller SSMs.

 Exposure duration. The length of time an animal is exposed to a drug or chemical. In general, there are four subgroups:

 Acute: Exposure to a single or multiple doses of toxicant during a 24-hour period. The LD50 is often determined during acute exposure studies.

 Subacute. Exposure to multiple doses of a toxicant for greater than 24 hours, but for as long as 30 days.

 Subchronic. Exposure to toxicant lasting from 1 to 3 months.

 Chronic. Exposure to toxicant for 3 months or longer.

Chronic duration carcinogenicity studies in rats can last up to 2 years (104 weeks), whereas chronic duration (life span) studies in dogs can last several years.

 Hazard (risk). Hazard, or risk, is the likelihood that a chemical or drug will cause harm under certain conditions..

 Carcinogenicity: It's the ability of a compound or chemical to transform normal cells into progressively & uncontrollably proliferating ones & resulting into neoplasms or cancer. Generally , any substance shown to induce cancer or neoplasm is termed as carcinogen e.g., cadmium,…..etc..

 Teratogenicity: is the ability of an agent to induce gross structural (anatomical) or and physiological malformations in a developing fetus during gestation. The word teratology or the study of congenital defects is derived from Greek word teras which means monster such agents are termed as teratogens e.g. Thalidomide, methotrexate, colchicine, cortisone and principles of certain plants as *Veratrum californicum.*