AL-Mustaqbal University College

Medical laboratory Techniques Department

Clinical Biochemistry

(Toxicology)

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Toxicology

Toxicology is a field of science that helps us understand the harmful effects that chemicals, substances, or situations, can have on people, animals, and the environment .

-Some refer to toxicology as the “Science of Safety” (SOT) because as a field it has evolved from a science focused on studying poisons and adverse effects of chemical exposures.

Toxicology uses the power of science to predict what, and how chemicals may cause harm and then shares that information to protect public health.

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A toxicologist

- Is a scientist who has a strong understanding of many scientific disciplines, such as biology and chemistry, and typically works with chemicals and other substances to determine if they are toxic or harmful to humans and other living organisms or the environment.
- Is an applied science with many areas of specialization. Involves integration of information from many different areas of expertise.

1 Toxic substances

1. Phytotoxins Plants
2. Zootoxins animals
3. Bacteriotoxins
4. Substances manufactured by humans that are not naturally found in the body. Xenobiotics

2 Toxicology is based on many other sciences, including:

A. Pharmacology as it is useful in studying a range of toxic compounds and drugs of plant origin
B. Pharmacology, where there is a close relationship between toxicology and pharmacology in terms of a joint research method
C. Biochemistry to study metabolism and effects at the molecular level
D. Analytical chemistry to know the methods of detection and the quantitative and qualitative analysis of the toxic substance-
E. Organic chemistry and pharmaceutical chemistry. Get an idea of the chemical structure of toxic compounds, which makes it easy to classify them into groups according to their structure.
F. Physiology to know the effect of toxins on the various tissues and organs of the body

Toxic & Dose of substance

It is any external source substance that enters the living body in specific quantities and under specific conditions and leads to certain functional disorders or affects several vital functions and this disorder is represented by inhibiting this function or functions, which often leads to death.

In toxicology, we distinguish according to the amount of substance absorbed in the body:

- Dose Toxic: It is the amount of a substance that, if it enters the body, leads to the emergence of toxic effects
- Lethal dose: It is the dose that leads to death most often and is estimated at Kg / mg or m mol / Kg, mol / Kg, or g / K

The effect of the toxic substance on the level of tissues and organs:

1-Effect on plasma:

- There are many toxins that change blood pH and cause acidity, such as alcohol.
- Metal toxins affect plasma proteins
- The ability of blood to clot decreases in benzene poisoning and when exposed to snake venom
- Some toxins lead to a decrease in the concentration of calcium, magnesium and zinc ions, as in the case of chronic lead poisoning and acute alcohol poisoning.
- Severe alcohol poisoning lowers blood sugar
- Plasma hormones may sometimes be affected by the effect of thyroxine in iodine poisoning.

The effect of the toxic substance on the level of tissues and organs:

2- Effect on red blood cells:

- Its concentration increases in some cases of poisoning.
- The number of RBC decreases due to their destruction by the effects of some toxins such as hydrogen arsenic, lead and phosphorous.
- A deficiency in red blood cells also occurs due to a deficiency in the manufacturing process, due to the direct effect on bone marrow, as in chronic benzene poisoning and when exposed to X-rays, nuclear.

The effect of the toxic substance on the level of tissues and organs:

3- Effect on hemoglobin:

- Hemoglobin is a conjugate of globin with heme, and heme is composed of protoporphyrin and iron binary by Chelatase enzyme.

4- Effect on white blood cells:

- Toxins affect the total number of white blood cells, increasing or decreasing.

The effect of the toxic substance on the level of tissues and organs:

5- The effect on platelets:

- The platelet count is significantly decreased in benzene poisoning and some compounds used in the treatment of cancer and whenX-ray exposure.

6- The effect on the liver:

- The liver is the body's main line of defense against most toxic substances that enter the body when they pass it.

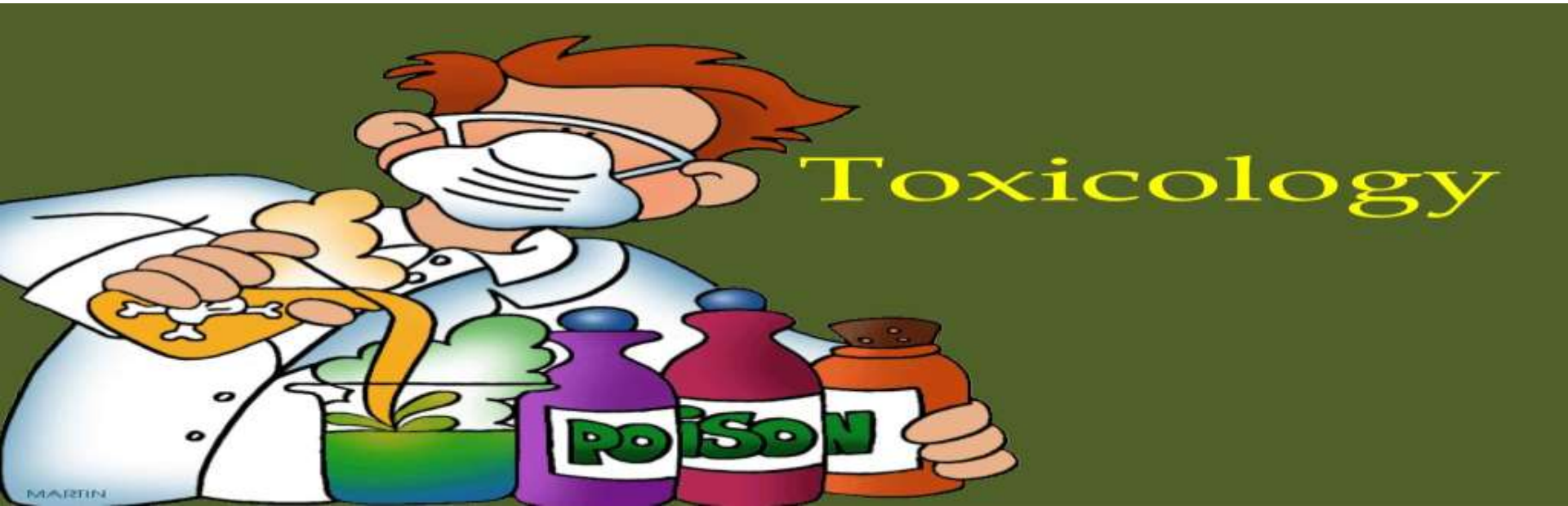
The effect of the toxic substance on the level of tissues and organs:

- The effect on the liver takes many forms:
- Cirrhosis may progress to cirrhosis: as in the case of chronic alcohol poisoning.
- Jaundice: hydrogen arsenic poisoning
- Liver cancer: with chronic exposure to some colourants.
- Liver necrosis: occurs in paracetamol poisoning
- Hepatomegaly: in organochlorine insecticide poisoning

The effect of the toxic substance on the level of tissues and organs:

7-The effect on the kidneys:

- Rapid and frequent blood flow
- Its ability to concentrate substances and biotransformations of toxic compounds



Classification of toxic substances

Toxins can be classified in several ways:

1 - By origin: animal - vegetable - mineral - organic.

2 - According to the location of the effect: blood, respiratory, hepatic, heart

3 - According to the mechanism of action: inhibiting enzymes - physiological antagonism .....

4 - According to the physical form: gaseous - volatile - hollow - solid .....

5 By chemical properties: acidic - alkaline ....By toxicity: strong - medium - light ...

Types of poisoning:

1- Acute Intoxication

- To distinguish between three types of acute poisoning:
- **Acute poisoning**: is the entry of relatively large quantities of a toxic substance into the body at one time and the emergence of severe symptoms, most of which are encountered in accidents such as suicide, poisoning, or negligence.
- Super acute or lightning poisoning: it occurs within a few minutes, and in this case, the poisoned person cannot be treated.
- Subacute poisoning: It is taking large quantities of a toxic substance in successive batches, which leads to the emergence of symptomsLighter and different from acute

Types of poisoning:

2- Chronic Intoxication

- is the entry of a toxic substance into the body in small amounts frequently and over a long period of timeThis type of poisoning is characterized by the emergence of specific symptoms determined by the nature of the toxic substance, as these symptoms appear suddenly and without prior warning.
- The toxic substance accumulates gradually and selectively in a specific organ or tissue of the body until it reaches the threshold of toxic effect, where symptoms of poisoning appear, and this effect becomes very dangerous if the matter is related to a carcinogen.


THANK YOU