



Introduction

By

Hassan Mohammed Al-Mahbashi
Associated Professor of Pharmacology &
Toxicology

Toxicology

- Toxicology is the study of the harmful effects of chemicals on living systems, (human, animal, plant or microbe).
- These effects can range from a life threatening injury to something that might be considered a minor effect.

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HISTORY OF TOXICOLOGY

- Toxicology dates back to the earliest humans, who used
- animal venom and plant extracts for
 - » hunting,
 - » warfare,
 - » assassination.



HISTORY OF TOXICOLOGY

- Prehistoric humans categorized some plants as harmful and others as safe.



History



2700 B.C. - Chinese journals: plant and fish poisons



00-1200 B.C. - Egyptian documents that mention collection, preparation, and administration of medicinal and poisonous recipes.

800 B.C. - India - Hindu medicine includes notes on poisons and antidotes.



50-100 A.D. - Greek physicians classified over 600 plant, animal, and mineral poisons.

History

50- 400 A.D. - Romans used poisons for executions and assassinations.



Philosopher, Socrates, was executed using hemlock for teaching radical ideas to youths.

Avicenna (A.D. 980-1036) Islamic authority on poisons and antidotes.



1200 A.D. - Spanish rabbi Maimonides writes first-aid book for poisonings, Poisons and Their Antidotes





Toxicology

- Toxicology—the science that deals with the study of the adverse effects (toxicities).



A poison

- As any agent capable of producing a deleterious response in a biological system, seriously injuring function or producing death.





Toxin



- Generally refers to toxic substances that are produced by biological systems such as plants, animals, fungi or bacteria.



Toxicant

- Is used in speaking of toxic substances that are produced by or are a byproduct of anthropogenic (**human-made**) activities e.g. "dioxin" [2,3,7,8 tetrachlorodibenzo- p-dioxin (TCDD)], produced during the combustion of certain chlorinated organic chemicals, is a toxicant.



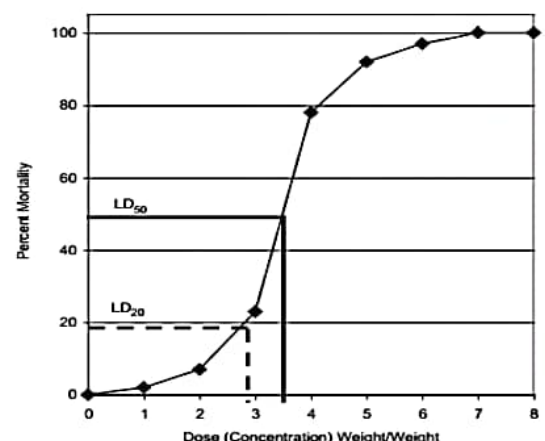
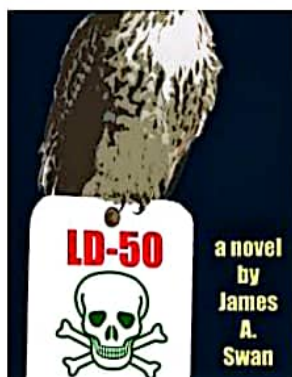
Xenobiotic

- A chemical which is foreign to the normal physiology of body or a living organism .
- E.g
- Drugs
- Pesticides



LD 50(Lethal Dose)

- There are many measures of toxicity, one that is commonly used is the LD 50 value, or lethal dose 50 percent. This is the dose that will result in the death of half of a test population that is exposed to this level of the substance in a single dose.



Scope of toxicology



Environmental toxicology

- Environmental toxicology is concerned with the movement of toxicants and their metabolites and degradation products in the environment and in food chains and with the effect of such contaminants on individuals and, especially, populations.



Industrial toxicology

- Industrial toxicology is a specific area of environmental toxicology that deals with the work environment and constitutes a significant part of industrial hygiene.



Forensic toxicology

- Forensic toxicology concerns the medicolegal aspects, including detection of poisons in clinical and other samples.



Veterinary toxicology

- Veterinary toxicology is the diagnosis and treatment of poisoning in animals other than humans.



Clinical toxicology

- Clinical toxicology is the diagnosis and treatment of human poisoning.



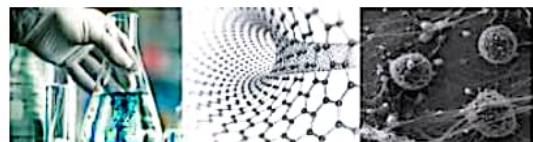
Analytical toxicology

- Analytical toxicology is a branch of analytical chemistry concerned with the identification and assay of toxic chemicals and their metabolites in biological and environmental materials.



Biochemical and molecular toxicology

- Biochemical and molecular toxicology consider events at the biochemical and molecular levels, including enzymes that **metabolize xenobiotics**, **generation of reactive intermediates**, **interaction of xenobiotics** or their metabolites **with macromolecules**, gene expression in metabolism and modes of action, and signaling pathways in toxic action



Different Areas of Toxicology

- The professional activities of toxicologists fall into three main categories:
 1. Descriptive
 2. Mechanistic
 3. Regulatory

A descriptive toxicologist

- Is concerned directly with toxicity testing, which provides information for **safety evaluation** and **regulatory requirements**

A mechanistic toxicologist

- Is concerned with identifying and understanding the **cellular, biochemical, and molecular mechanisms** by which chemicals exert toxic effects on living organisms.

A regulatory toxicologist

- **Toxicologist** has the responsibility for deciding, on the basis of data provided by descriptive and mechanistic toxicologists, whether a drug or another chemical poses a sufficiently low risk to be marketed for a stated purpose

A regulatory toxicologist

- The Food and Drug Administration (**FDA**) is responsible for allowing drugs, cosmetics, and food additives to be sold in the market according to the Federal Food, Drug and Cosmetic Administration (**FDCA**).

Route and Site of Exposure

- Gastrointestinal tract (ingestion),
- Lungs (inhalation),
- Skin (topical, percutaneous, or dermal),
- Parenteral (other than intestinal canal) routes

Effectivity

- inhalation > intraperitoneal > subcutaneous > intramuscular > intradermal > oral > dermal.

Duration and Frequency of Exposure

- Toxicologists usually divide the exposure of experimental animals to chemicals into four categories:
 - Acute
 - Subacute
 - Subchronic
 - Chronic



Mode of poisoning(Medico-legal Aspects)

- Accidental
- Suicidal
- Homicidal



Types of exposure

1. Intentional ingestion
2. Occupational exposure
3. Environmental exposure
4. Accidental poisoning
5. Intentional poisoning (suicidal or homicidal)

CLASSIFICATION OF TOXIC AGENTS

- Toxic agents are classified in a variety of ways, depending on the interests and needs of the classifier.



Type of action

Local action

Immediate & Severe Destructive effect

- E.g strong Corrosives (Acids & Alkalis)

Systemic action

Act after Absorption

- e.g Atropine.

Mixed (Double Action)

Mild Local Irritant

e.g Metals, Oxalic acid & Phenol

Physical state

Gas
CO, HCN

Liquid
chloroform

Solid
Iron,
aspirin