Toxicity and its Assessment

Subject: Toxic substances and Human Health
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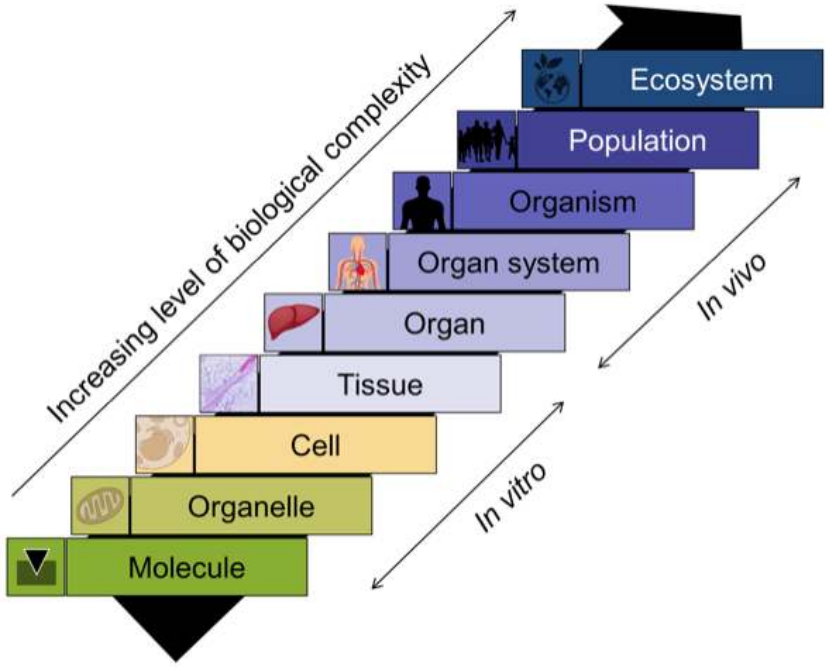
What is toxicity???????

- Toxicity is the ability of a substance to cause harmful health effects.

- These effects can strike a single cell, a group of cells, an organ system, or the entire body.



The toxicity of a substance depends on three factors:

- its chemical structure,
- the extent to which the substance is absorbed by the body, and
- the body's ability to detoxify the substance (change it into less toxic substances) and eliminate it from the body.

Route of exposure

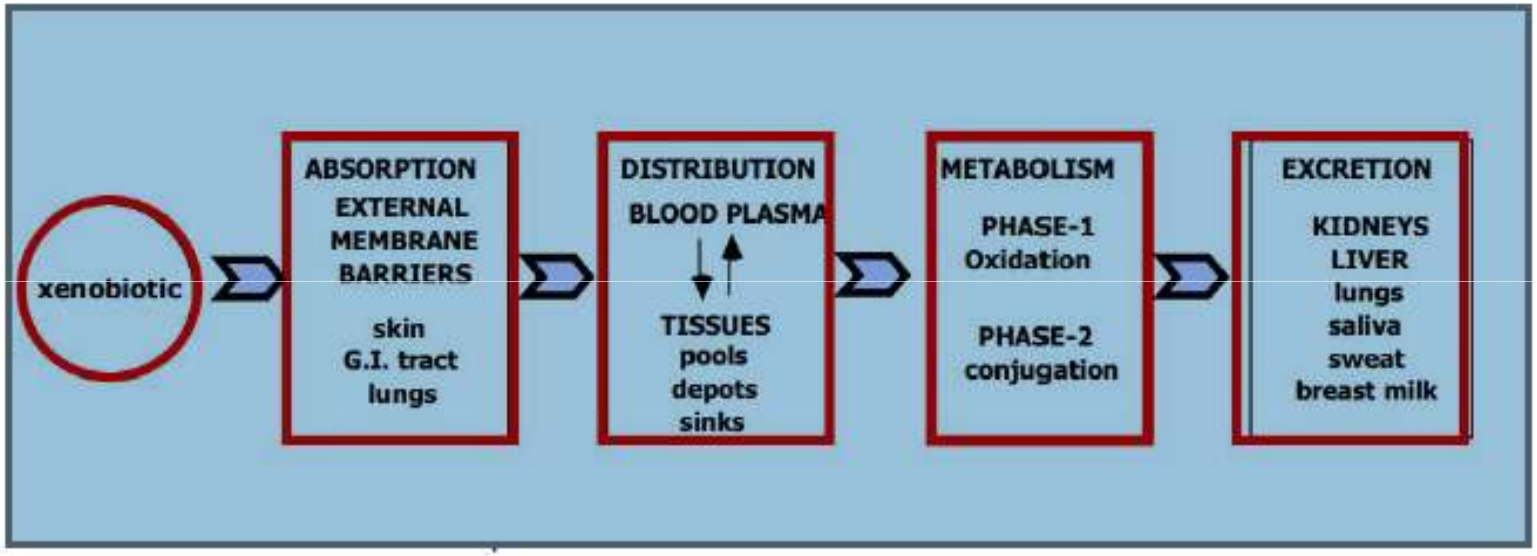
- **Inhalation:** A very important type of workplace exposure occurs when you breathe a substance into the lungs.

- **Skin Contact:** The skin is a protective barrier that helps keep foreign chemicals out of the body.

- **Eye Contact:** Some chemicals may burn or irritate the eye.

- **Ingestion (swallowing):** Chemicals can be ingested if they are left on hands, clothing, or beard, or when they accidentally contaminate food, drinks, or cigarettes.

FATE OF A TOXICANT



Routes of Absorption, Distribution and Excretion

Routes of Absorption:

- Ingestion
- Inhalation
- Dermal
- Inhalation
- Intravenous
- Intraperitoneal
- Intramuscular
- Subcutaneous

Routes of Distribution:

- Systemic circulation
- Portal circulation
- Lymphatic system
- Fat
- Extracellular fluid
- Organs

Routes of Excretion:

- Feces
- Urine
- Expired air
- Secretions

What is DOSE?

Dose: The amount of a chemical that actually gets into your body is the dose. And because your body actually responds to the concentration in your blood and tissues, the dose is always expressed relative to your body weight.

What is RESPONSE?

Response: Response is how the body reacts to a chemical. Your body can react to a chemical in different ways depending on the properties of the chemical and the dose.

Dose-Response Relationship

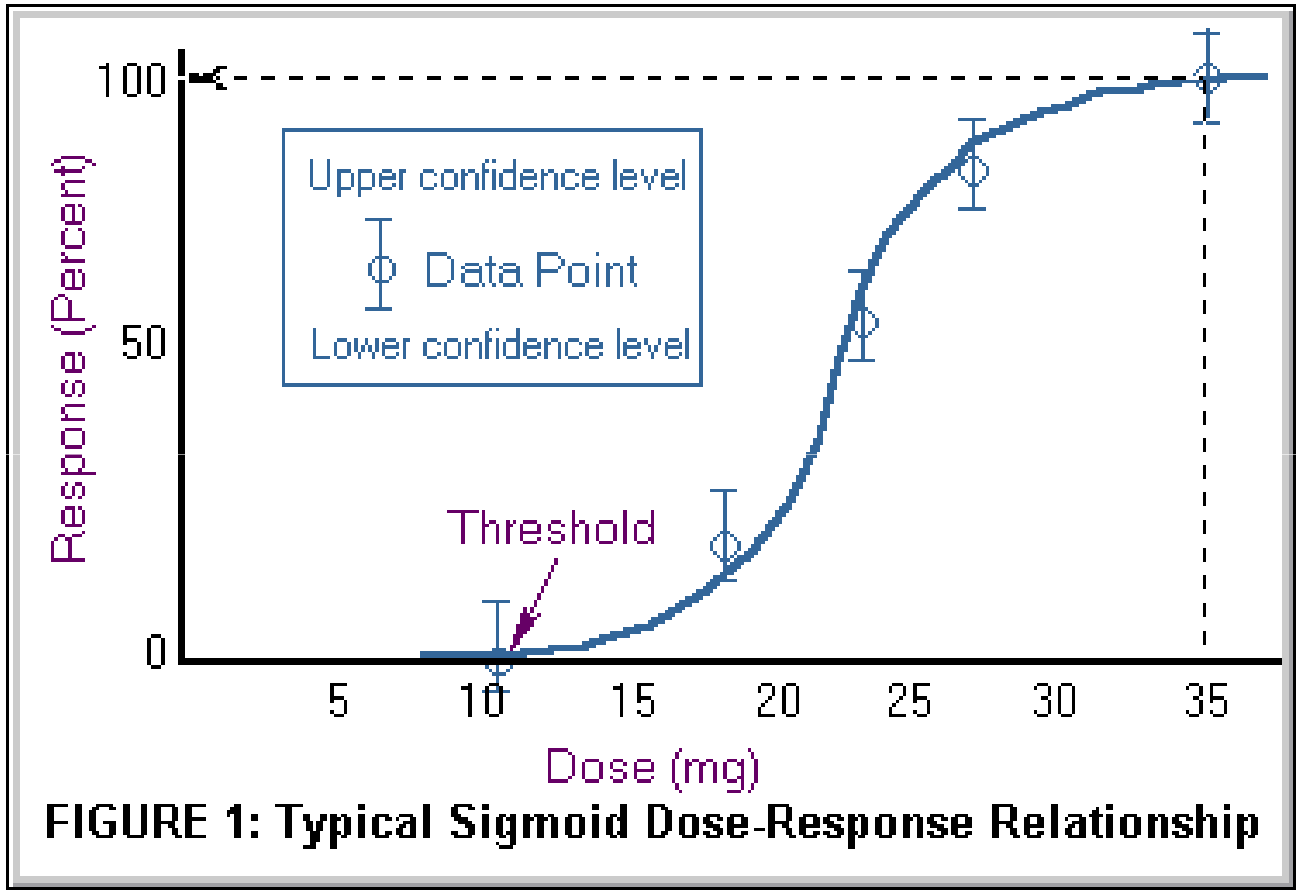


FIGURE 1: Typical Sigmoid Dose-Response Relationship

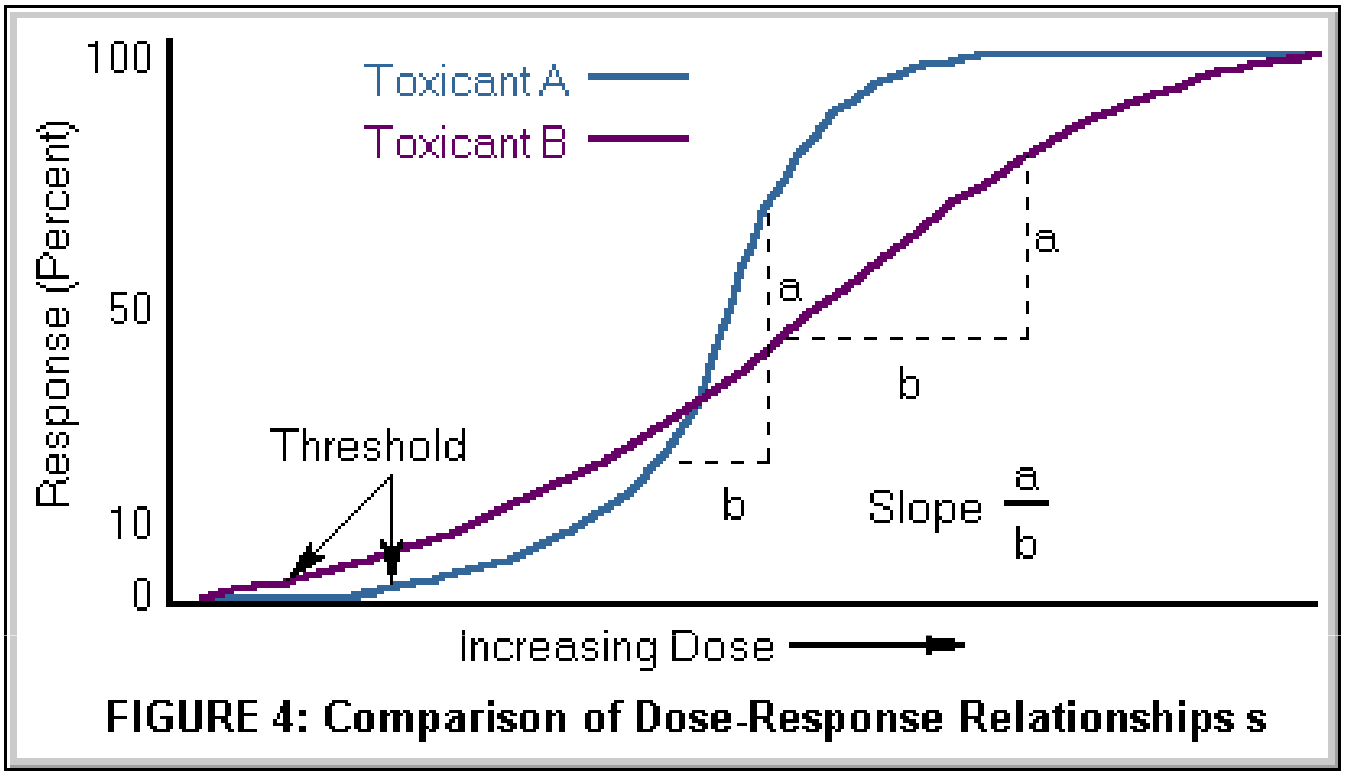


FIGURE 4: Comparison of Dose-Response Relationships s

Toxicant A has a higher threshold but a steeper slope than Toxicant B, the implication being that comparatively, Toxicant B is more toxic at lower dosages and Toxicant A more toxic at higher dosages.

The threshold may also be referred to as the LOAEL, Lowest Observed Adverse Effect Level or NOAEL, No Observed Adverse Effect Level.

Acute vs. Chronic Toxicity Tests

Can broadly classify toxicity tests based on *length of exposure*

- Acute Toxicity test
  - Drop dead testing
  - Time = 2 days (invertebrates) to 4 d. (fish)
    - LD_{50}
    - LC_{50}
    - TLm (median tolerance dose)
    - EC_{50} (effective concentration)
      - Lose equilibrium, sit on bottom → "ecologically" dead
- Chronic toxicity testing
  - Growth, reproduction
  - More ecologically relevant data but takes longer, more expensive
  - Shows effect at much lower dose

THANKYOU