Toxicology - Core Concept Cheat Sheet

01: Introduction to Toxicology

Key Terms

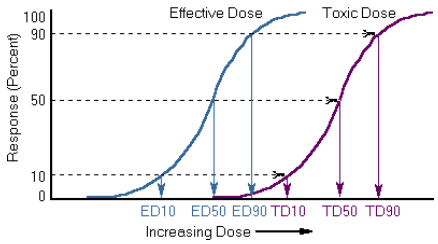
- **Toxicology:** study of the adverse effects of chemicals on living organisms
- **Poison:** any agent capable of causing harm in a biological system
- **Toxin:** toxic substance produced by biological systems (plants, fungi, animals, bacteria)
- **Toxicant:** toxic substance produced by human activity
- **Antagonism:** chemicals work against each other
- **Tolerance:** decreased responsiveness to a chemical
- **Dose-response:** relationship between exposure to a chemical and the magnitude of the response
- **Potency:** range of doses over which a chemical produces increasing responses
- **Efficacy:** capacity of drug or toxicant to cause a specific functional response

Toxicology Terminology

- **Toxicology:** study of the adverse effects of chemicals on living organisms
  - **Types:** forensic, environmental, developmental, reproductive
- **Toxicologist:** trained to examine adverse effects and determine the probability of occurrence
  - **Types:** mechanistic, descriptive, regulatory
- **Poison:** any agent capable of causing harm in a biological system
- **Toxin:** toxic substance produced by biological systems (plants, fungi, animals, bacteria)
- **Toxicant:** toxic substance produced by human activity

Characteristics of Exposure and Effect

- **Durations of exposure:**
  - **Acute:** less than 24 hr
  - **Chronic:** repeated exposure for more than 3 months
  - **Subchronic:** 1 to 3 months
  - **Subacute:** 1 month or less
- **Effects of exposure:**
  - **Allergic response:** mediated by immune system; prior sensitization to chemical or structurally related chemical
  - **Idiosyncratic reaction:** genetically determined, abnormal adverse response to chemical
- **Timing of reactions:**
  - **Immediate:** develop quickly after exposure to toxicant
  - **Delayed:** become evident days, weeks, or even years after exposure
- **Severity of reactions:**
  - **Reversible vs. irreversible:** difference depends on 1) severity of exposure 2) regenerative capacity of affected tissue
- **Locality of reactions:**
  - **Local effects:** take place at site of exposure
  - **Systemic effects:** require absorption into the body and distribution to the site of action



Interactions with Toxicants

- **Combined effects of chemicals:**
  - **Additive:** effect of two or more chemicals equals the sum of each individual chemical alone
  - **Synergistic:** combined effects of two chemicals are greater then the sum of the effects of each individual chemical
  - **Potentiation:** occurs when the chemical itself is not toxic alone, but contributes to the toxicity of another chemical, making that chemical much more toxic

- **Antagonism:** chemicals work against each other – 4 types:
  - **Functional:** two chemicals work against each other by producing opposing effects in the same system
  - **Chemical:** two chemicals interact with each other to produce a less toxic combination
  - **Dispositional:** the biological actions on a chemical reduce its toxicity
  - **Receptor:** one chemical blocks the action of another at its receptor

- **Tolerance:** decreased responsiveness to a chemical – causes:
  - Reduction in amount of toxicant reaching site of action
  - Reduced responsiveness of tissue to the chemical

Dose-Response

- **Dose-response:** relationship between exposure to a chemical and the magnitude of the response – response is consistent, predictable, and can be measured
  - **Types of dose-response curves:**
    - **Individual:** described response of an individual organism to a specific chemical
    - **Quantal:** described the distribution of responses to different doses in a population of exposed organisms
  - Assumptions of the curve: 1) direct cause-and-effect relationship 2) magnitude of response is directly related to the dose 3) the response can be measured in a quantifiable manner that is accurate and repeatable

- Information that be learned from the dose-response curve:
  - **Threshold:** dose at which response is first evident
  - **Effective dose (ED):** dose at which a specific effect occurs
  - **Toxic dose (TD):** dose at which the toxic effect under observation becomes evident
  - **Lethal dose (LD):** dose at which exposure becomes lethal
  - **Therapeutic index (TI):** dose required to produce a toxic effect, divided by the dose required to produce the therapeutic effect
  - **Margin of safety (MOS):** the distance between the estimated dose to which a population is exposed, and the NOAEL (no observed adverse effect level), as determined in experimental animals – determined as the lethal dose in 1% of the population (LD1) divided by the effective dose in 99% of the population (ED99)
  - **Potency:** range of doses over which a chemical produces increasing responses
  - **Efficacy:** capacity of drug or toxicant to cause a specific functional response

How to Use This Cheat Sheet: These are the keys related this topic. Try to read through it carefully twice then write it out on a blank sheet of paper.