# 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 than 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.

![Dose-Response Curve](image)

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