

CHAPTER OVERVIEW

Section 10: Absorption

Learning Objectives

After completing this lesson, you will be able to:

- Explain absorption and its role in toxicokinetics.
- Describe the primary routes of exposure.
- Explain the role of cell membranes in absorption.
- Identify ways in which xenobiotics pass across cell membranes.

In this section...

Topics include:

- [10.1: Introduction to Absorption](#)
- [10.2: Gastrointestinal Tract](#)
- [10.3: Respiratory Tract](#)
- [10.4: Dermal Route](#)
- [10.5: Other Routes of Exposure](#)

Section 10: Key Points

What We've Covered

This section made the following main points:

- Absorption is the process by which toxicants gain entrance into the body.
- Ingested and inhaled materials are considered outside the body until they cross the cellular barriers of the gastrointestinal tract or respiratory system.
- The likelihood of absorption depends on the:
 - Route of exposure.
 - Concentration of the substance at the site of contact.
 - Chemical and physical properties of the substance.
- Exposure routes include:
 - Primary routes:
 - Gastrointestinal (GI) tract
 - Mouth and esophagus — poorly absorbed under normal conditions due to short exposure time (nicotine and nitroglycerin are notable exceptions).
 - Stomach — significant site for absorption of weak organic acids, but weak bases are poorly absorbed.
 - Intestine — greatest absorption of both weak bases and weak acids, particularly in the small intestine.
 - Colon and rectum — very little absorption, unless administered via suppository.
 - Respiratory tract
 - Mucociliary escalator — movements of the cilia push mucus and anything contained within up and out into the throat to be swallowed or removed through the mouth.

- Pulmonary region — most important site for absorption with about 50 times the surface area of the skin and very thin membranes.
- Skin
 - Epidermis and stratum corneum — the only layer important in regulating the penetration of a skin contaminant.
 - Toxicants move across the stratum corneum by passive diffusion.
 - If a toxicant penetrates through the stratum corneum, it enters lower layers of the epidermis, dermis, and subcutaneous tissue, which are far less resistant to further diffusion.
- Other exposure routes:
 - Injections
 - Implants
 - Conjunctival instillations (eye drops)
 - Suppositories
- Cell membranes surround all body cells and are made up of a phospholipid bilayer in which each molecule contains a:
 - Polar (hydrophilic, or attracted to water) phosphate head
 - Lipophilic (attracted to lipid-soluble substances) lipid tail
- Xenobiotics must pass across cell membranes to enter, move within, and leave the body. This movement can be either:
 - Passive transfer (most common) — simple diffusion or osmotic filtration with no cellular energy or assistance required.
 - Facilitated transport — similar to passive transport, but a carrier-mediated transport mechanism and thus faster and capable of moving larger molecules.
 - Active transport — movement against the concentration gradient (from lower to higher concentrations), requiring cellular energy from ATP.
 - Endocytosis — the cell surrounds the substance with a section of its cell wall, separating from the membrane and moving into the interior of the cell.

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