Module Two

Routes of Exposure
Objectives

Upon completion of this module, you will be able to:

- Define and understand the types of environments
- Identify the protective barriers of the body
- Identify the routes of exposure
- Identify the pathways of exposure
- Identify the types of exposure
- Understand local and systemic exposures
- Identify the pathways for excretion of toxins
Environment

- Inner vs outer environment
- Personal vs ambient environment
- Gaseous, liquid, and solid environment
- Chemical, biological, physical, and socioeconomic environments
Inner vs Outer Environment

- Refers to the human body
- Consists of the inner and outer body
- Has three protective barriers
  - Skin
  - Gastrointestinal Tract
  - Lungs
Protective Barriers

- Skin, which protects the body from contaminants (toxins) outside the body
- Gastrointestinal tract, which protects the inner body from some ingested contaminants
- Lungs, which protect the body from contaminants inhaled
Personal vs Ambient Environment

- **Personal environment**
  - The environment you control

- **Ambient environment**
  - The environment you cannot control
Gaseous, Liquid, Solid Environment

- Gaseous (Air)
- Liquid (Water)
- Solid (Land, Soil)
Chemical, Biological, Physical, and Socioeconomic Environments

- Chemical factors and contaminants (Toxic waste pesticides in the environment)
- Biological factors (Disease organisms in food and water)
- Physical factors (Elements influencing health and well-being)
- Socioeconomic factors (Economic status directly affecting health)
Routes of Exposure
Exposure Routes

- DERMAL (skin)
- Inhalation (respiratory tract)
- Ingestion (stomach or digestive tract)
Dermal Absorption Route
Skin

- Route of exposure is absorption
  - This is the most common path of toxic substances exposure
Layers of the Skin

- Epidermis (outer layer)
  - Stratum corneum
- Dermis (inner layer)
- Subcutaneous fatty tissue
Factors Affecting Dermal Absorption

- Condition of the skin
- Chemical makeup
- Increased toxic substance concentration
Inhalation Route
Respiratory Tract

- Route of exposure is inhalation (breathing)
  - This is the easiest and fastest means of exposure
Factors Affecting Respiratory Absorption

- Concentration of toxic substance in the air
- Solubility of the substance in blood and tissue
- Respiration rate/respiratory tract condition
- Length of exposure
- Size of toxic particle
Ingestion Route
Route of exposure is ingestion (swallowing or eating)

- Ingestion of toxic substances occurs accidentally or unknowingly
The Digestive Tract

- Mouth and pharynx
- Esophagus
- Stomach
- Small intestine
- Large intestine
Factors Affecting Absorption (Ingestion)

- **Physical**
  - The small intestine surface area

- **Chemical**
  - The size of particle/substance
  - The length of time food containing the substance remains in the body
Other Routes of Exposure
The Eye

- Lens
- Choroid
- Iris
- Aqueous humor
- Cornea
- Vitreous humor
- Sclera
Injections

- Intravenously (into a vein)
- Intramuscularly (into the muscle)
- Intraperitoneally (into the peritoneal cavity)
  - Covers wall of organ and inner lining of stomach
- Intradermally (into the skin)
- Subcutaneously (under the skin)
Length of Exposure

- Acute ($\leq 24$ hours)
- Chronic ($> 3$ months)
- Sub-acute ($\leq 1$ month)
- Sub-chronic (between 1 and 3 months)
Effects After Exposure

- Local
- Systemic
  - Biotransformation
  - Excretion
  - Target tissues
Excretion of Toxins

Toxins leave the body through:

- Kidney (Urine)
- Feces
- Lungs (e.g., mucus, breathing out)
Question and Answer Period