Mechanism of poisoning

A **poison** is a substance that, when administered in small amounts, causes pathological changes or even death due to its chemical properties. Poisons act in the body through various mechanisms:

- **Etching**

  This term means local denaturation of tissue components by caustics, i.e., strong acids with pK <2, e.g., H_2SO_4 , HCl or HNO , or strong bases (alkalis) with pK > 11.5, e.g., NaOH, KOH, NH_4OH.
  🔎 *For more information see Ingestion of acids and bases.*

- **Covalent nonspecific interactions with biomolecules (proteins, nucleic acids and polysaccharides)**.

  Highly reactive aldehydes are examples of these poisons. The aldehyde group -CHO reacts readily with the amino group $-NH_2$ or the sulfhydryl group -SH, which is abundant in proteins. An example is methanal (formaldehyde, HCHO). Its aqueous saturated solution is known as formalin.

- **Disturbances of acid-base balance**.

  Some poisons disturb the acid-base balance of the organism.[1] Ethylene glycol is oxidized by alcohol dehydrogenase to glycolic, glyoxal, and oxalic acids, which cause metabolic acidosis. Salicylates stimulate the respiratory center. The resulting hyperventilation leads to respiratory alkalosis. After entering the cells, they disrupt oxidative phosphorylation in the mitochondria, reduce ATP production, block citrate cycle enzymes, and stimulate anaerobic glycolysis. The result is the overproduction and accumulation of acidic metabolites, mainly lactate, pyruvate, and acetoacetate, and thus the development of metabolic acidosis.
  🔎 *For more information see Alcohol intoxication.*

- **Effect on membranes**

  Ethanol, detergents, and hydrocarbons change the fluidity of the membranes, which is reflected in the function of the membrane components. Changes in membrane microviscosity change the conformation of membrane channels, receptors and enzymes, and thus disrupt their functions (membrane transport, signaling, membrane potential). Membrane fluidity is a control mechanism for heavy metal absorption.
  🔎 *For more information see Alcohol intoxication.*

- **Interaction with oxygen transfer in the body**

  1. The binding of poison to hemoglobin
     🔎 *For more information see Carbon monoxide intoxication.*
  2. Oxidation of hemoglobin to methemoglobin
     🔎 *For more information see Intoxication with methemoglobinizing agents.*
  3. Cytochrome oxidase inhibition
     🔎 *For more information see Hydrogen cyanide and cyanide intoxication.*

- **Enzyme inhibition**

  1. Non-specific interactions, binding to the sulfhydryl group -SH.
  2. Binding of the poison to the active center of the enzyme.

- **Interactions with specific receptors and impairment of cell signaling or membrane channel function**

  Sodium channel, nicotine and muscarinic receptors, psychotropic drugs, addictive substances.

Citations

1. E-kurz o acidobazické rovnováze na univerzitním MOODLE (https://dl1.cuni.cz/course/view.php?id=110)