

Learning Objectives

- 1 List the different types of poisons and their effects
- 2 Describe the modes of actions of different types of poisons
- 3 Explain how toxicity is measured using LD₅₀
- 4 Explain the factors affecting LD₅₀ results
- 5 Illustrate why route of administration is important

Toxicology

Science of poisons and poisoning

Reasons



Accidental



Environmental



Occupational



Deliberate

Toxicology

Use of poisoning to commit murder



Common in the old days



Less common now



Chemicals tightly controlled

Corrosives

Strong acids and alkalis



Concentrated
sulfuric acid



Vitriol



GHS symbol for corrosives

**Victim of acid attack
in Cambodia, 2007**





**Victims of acid attack
in Bangladesh, 2011**

Housewife dies in acid attack, daughter injured

265 words

25 October 2009

New Sunday Times

NSUNT

11

English

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GEORGE TOWN: A 50-year-old housewife died of burns while her 18-year-old daughter is in danger of being blinded when a family member splashed acid on them early yesterday morning.

Cheong Swee Lin, who had 80 per cent acid burns on her body, died at the Penang Hospital's intensive care unit (ICU) nine hours after she was rushed there by her neighbours.

Doctors are now frantically trying to save Cheong's daughter, Tan Hooi Ling, who is also warded at the same ICU.

Acid attack case in Malaysia, 2009

Ameneh Bahrami

Before and after
her acid attack

Drastic effects of sulfuric
acid on the human body



Ameneh Bahrami

Irritants

Lead, mercury, arsenic



Irritate the gut



Cause nausea or diarrhoea



Other effects after absorption

Systemic Poisons

Attack biochemical systems in body

1 Cyanide → Interfere with action of mitochondria

2 Carbon monoxide → Hemoglobin

Systemic Poisons

3 Strychnine



Affects the nervous system

4 Morphine

5 Atropine



Affects the nervous system

6 Synthetic pesticides and nerve agents

Systemic Poisons

7 Inorganic poisons



Arsenic



Antimony



Mercury



Thallium

Cyanide

Cassava root is
a staple food



Cassava plant

Cyanide

Cutting open the cassava root



Plant releases cyanide

Few cases yearly



Cassava root not properly prepared

Carbon Monoxide (CO)

Poisoning by CO



Common



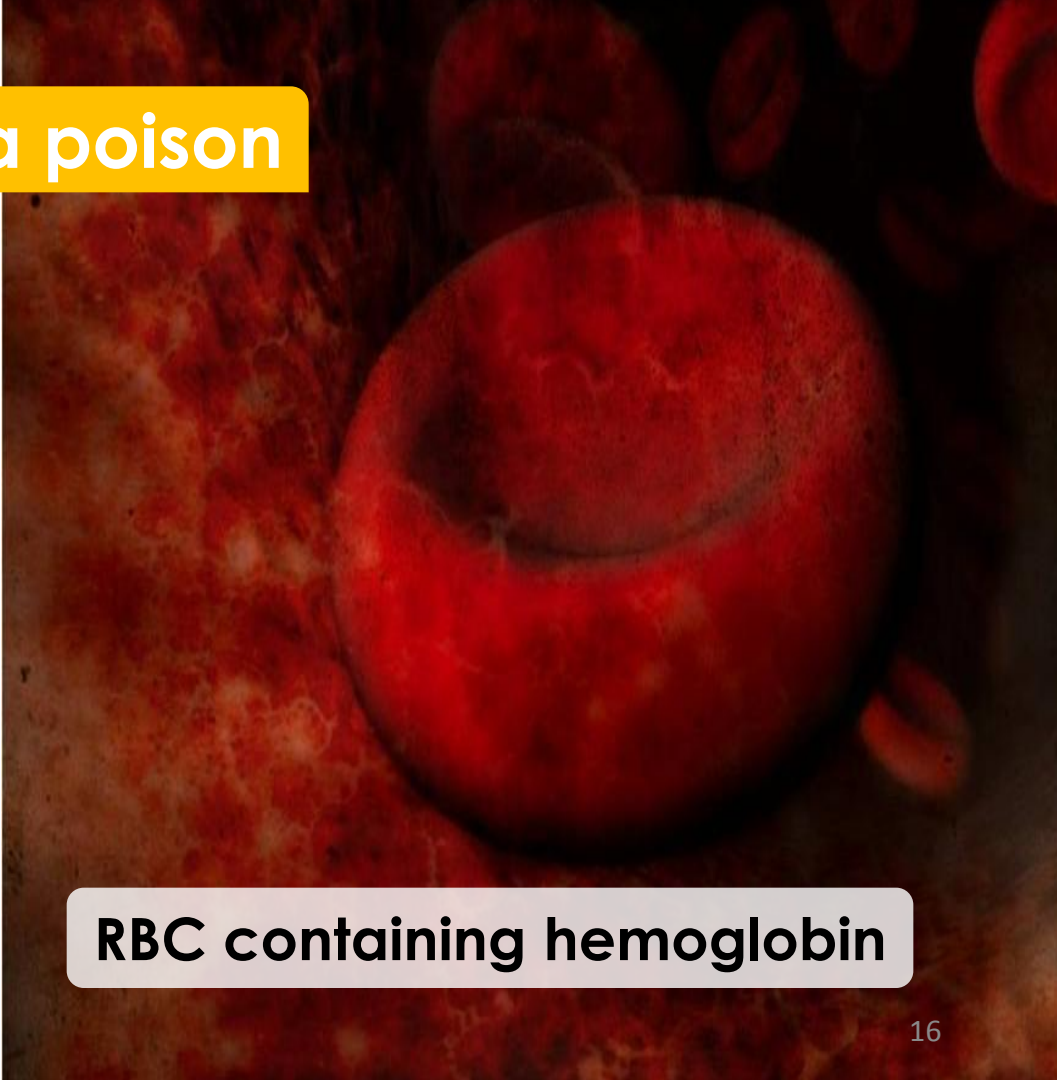
Accidental



Deliberate

How CO works as a poison

Blocks hemoglobin

A microscopic view of red blood cells, showing their characteristic biconcave disc shape and vibrant red color. The cells are densely packed, and the image is slightly out of focus, emphasizing the texture and color of the cells.

RBC containing hemoglobin

How CO works as a poison

Hemoglobin



Protein



Responsible for oxygen transport

How CO works as a poison

Always have some hemoglobin bound to CO



CO strongly bound; O₂ cannot compete



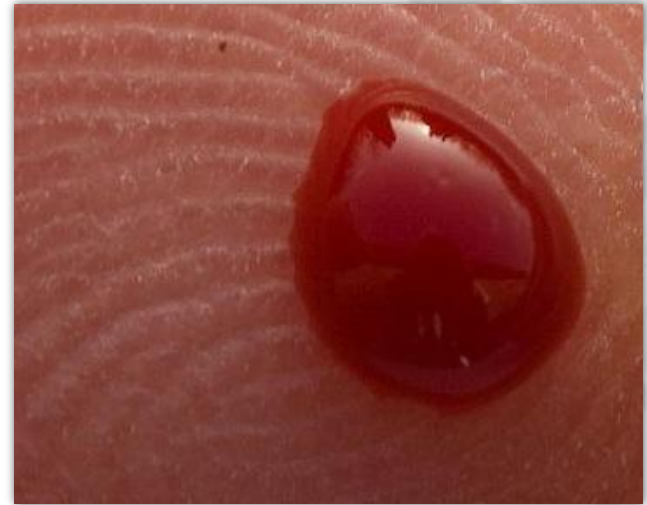
CO always present in air

Amount of CO in air too small to harm us

How CO works as a poison

Poisonous when CO in air rises above a certain level

Blood is red because of the hemoglobin



A drop of blood

Gas-Hemoglobin Complexes

Color of hemoglobin depends on the molecule bound to iron



Fe-O₂ complex



Red



Fe-CO complex



Pink

Sources of CO

Partial combustion of fuel
or other organic material

Burning butane gas (C_4H_{10})



In excess air



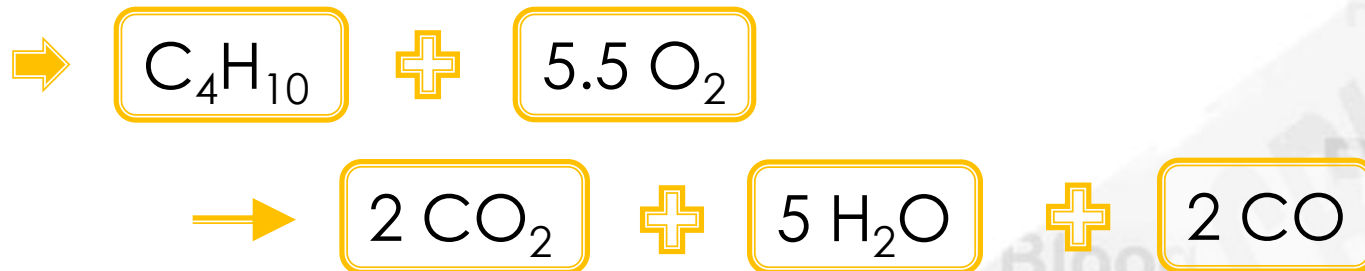
In limited amounts of air

Sources of CO

Burning butane (C_4H_{10}) in excess air



Burning butane (C_4H_{10}) in limited amounts of air



Sources of CO

Partial combustion of hydrocarbon fuels



Improper ventilation



CO concentration can build up to toxic levels

Presidente Hotel Poisoning

5 people killed

Rooms directly above parking garage



Stairs leading up from garage to room

Carbon Dioxide (CO₂)

Much less toxic than CO



Does not bind to hemoglobin

Asphyxiation



CO₂ replaces air



No oxygen

Lake Nyos, Cameroon, West Africa

Lake Nyos, Cameroon, West Africa

Old volcanic crater filled up with rainwater



Became a lake

Ground under lake giving off CO₂



CO₂ seeped into lake

Lake Nyos, Cameroon, West Africa

Cold water in lake's lower layer



Super-saturated with CO_2



CO_2 unable to escape due to warmer water above the cold lower layer