

Toxicants and Dose- Response

What is toxicology?



- The study of poisons
- The study of adverse effects of chemicals on living organisms

What is toxicant?

-Any substance that causes a harmful effect when administered to a living organism

What is toxin?

-A toxicant produced by a living organism

Toxicant \neq Toxin



Classes of Toxicants

Metals

Agricultural Chemicals

Toxins

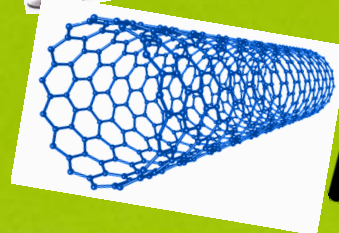
Combustion Products

Drugs of Abuse

Occupational Chemicals

Radioactive Substances

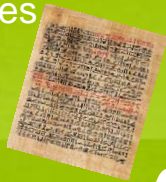
Emerging Contaminants



History of Toxicology

1500 BC

Ebers Papyrus mentions medicinal and poisonous mixtures



371-287 BC
Theophrastus describes poisonous plants



1493-1541

Paracelsus describes that "The dose makes the poison"



1714-1788

Percival Pott writes about association of scrotal cancer and chimney sweeps



399 BC

Socrates sentenced to death by hemlock poisoning



30 BC

Cleopatra commits suicide by snake bite after studying poisons



1547-1559

Queen Catherine de Medici of France tests poisons on the poor and sick



1962

Environmental toxicology gains international attention with publication of Rachel Carson's *Silent Spring*



Hodgson, E. (Ed.). (2004). *A textbook of modern toxicology*. John Wiley & Sons.

Richards, I. S., & Bourgeois, M. (2013). *Principles and practice of toxicology in public health*. Jones & Bartlett Publishers.

Are you a toxicant?

Table Salt

Dioxins

Tylenol

Water

Batrachotoxin

Alcohol

Caffeine

Nicotine

PCBs

DDT

Are you a toxicant?

YES

Table Salt

Dioxins

Tylenol

Water

Batrachotoxin

Alcohol

Caffeine

Nicotine

PCBs

DDT

No

Paracelsus – The Father of Modern Toxicology



“All substances are poisons; there is none which is not a poison. The right dose differentiates a poison from a remedy.”

Rank the toxicants from least to most toxic:

Table Salt

Dioxins

Tylenol

Water

Batrachotoxin

Alcohol

Caffeine

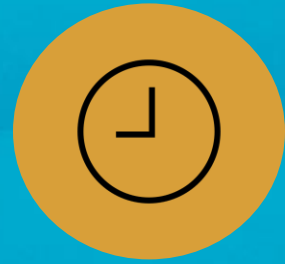
Nicotine

PCBs

DDT

Compound	LD50 (g/kg)
Water	>90
Alcohol	7.06
Table Salt	3
PCBs	2
Tylenol	1.944
Caffeine	0.192
DDT	0.135
Nicotine	0.0034
Dioxins	0.001
Batrachotoxin	0.000002

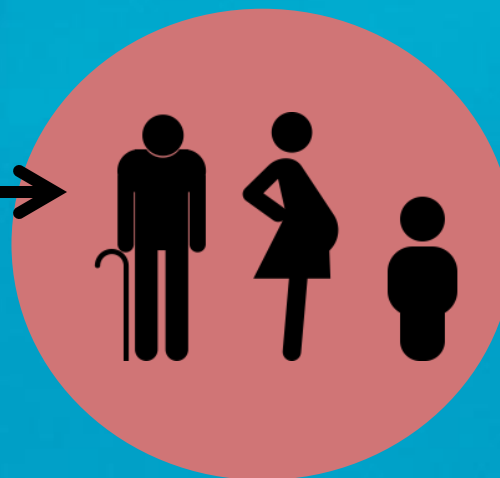
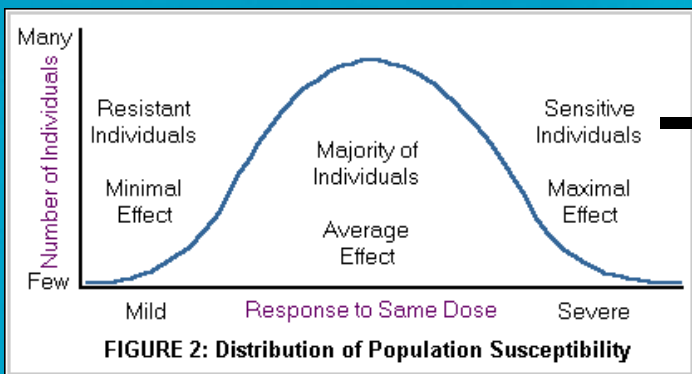
Considerations?



Others?



VS.



Lethal Dose



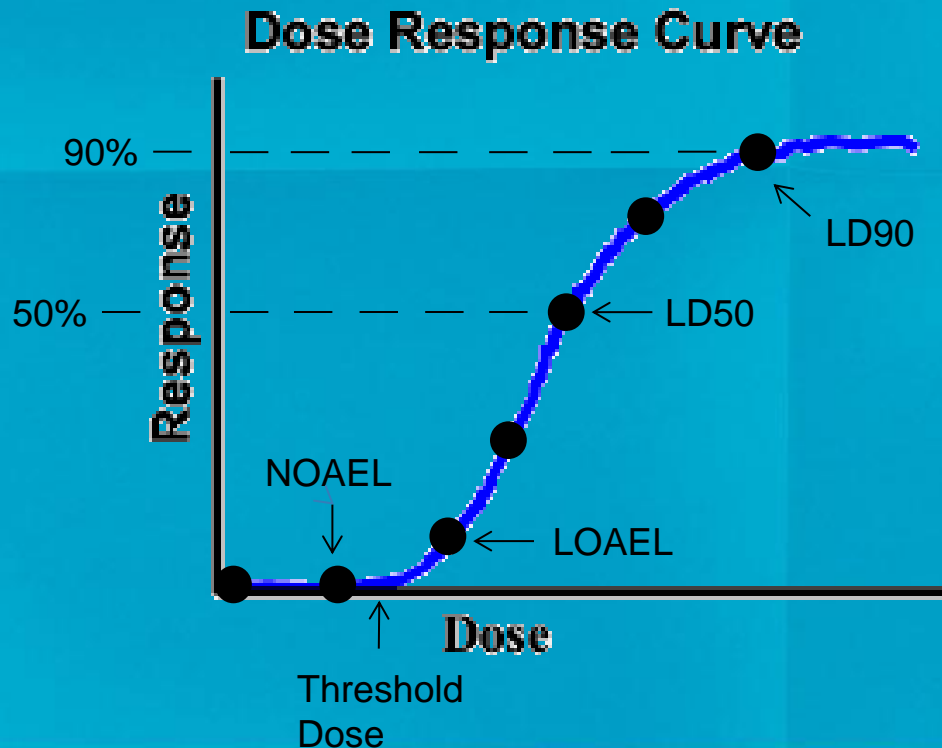
Toxic Dose



Effective Dose



Dose-Response Curve



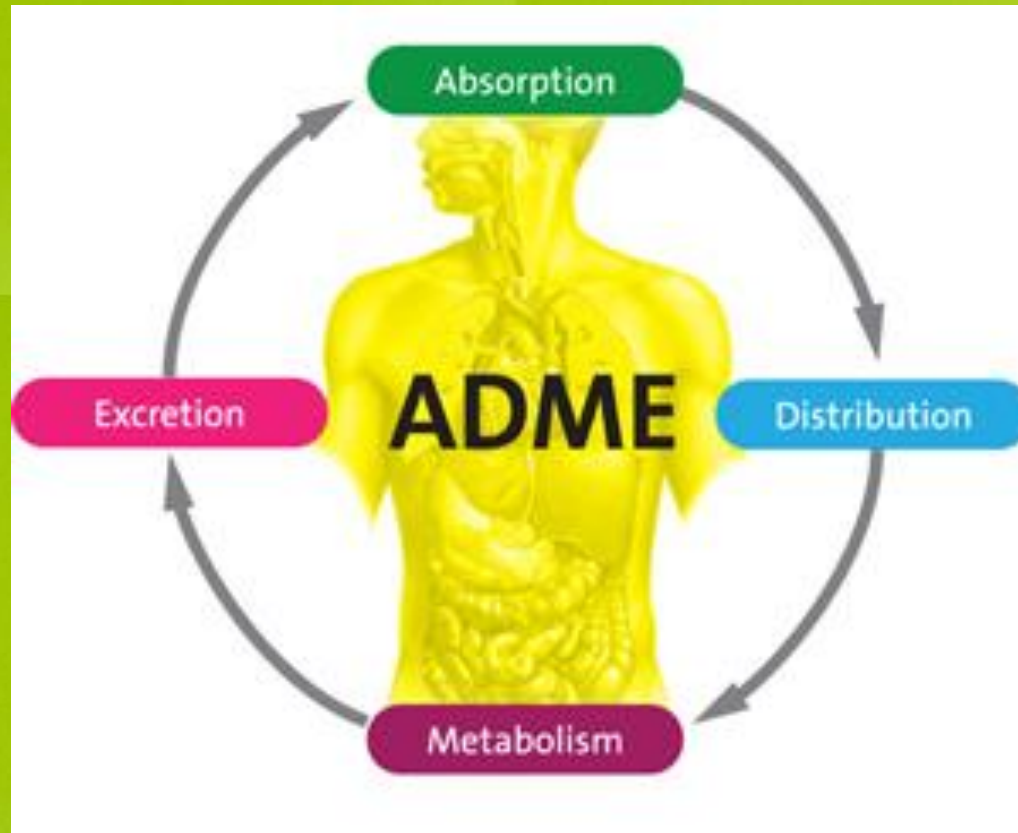
Threshold dose – dose at which the affect first appears; not a point

LD50 (Lethal Dose 50) – causes death in 50% of responders

NOAEL (No Observed Adverse Effect Level) – highest point with no response

LOAEL (Lowest Observed Adverse Effect Level) – lowest point with a response

ADME



ADME example

