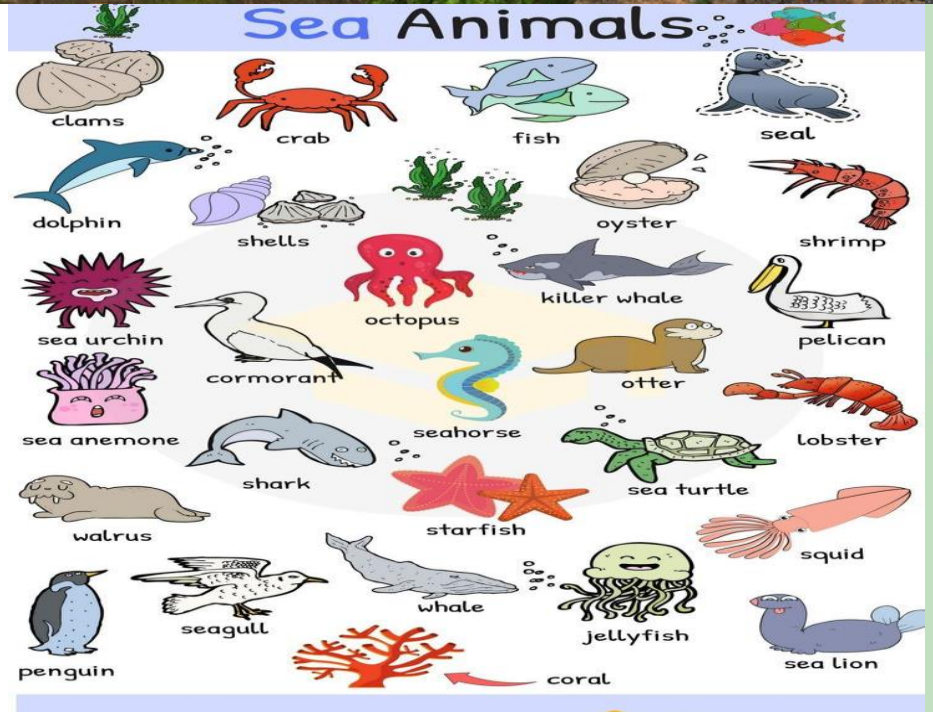
Animal, Plant & Environmental toxicity (Bt 412)



Brief history of toxicology

-Ebers Papyrus (□1500 B.C.)

-Socrates (470-399 B.C.)

-Cleopatra – Queen of Egypt (69-30 B.C.). Committed suicide with Egyptian cobra.

Brief history of toxicology

Swiss physician Paracelsus (1493-1541)
“the father of modern toxicology.”

- *What is Toxicology?*

What can a toxicologist do?

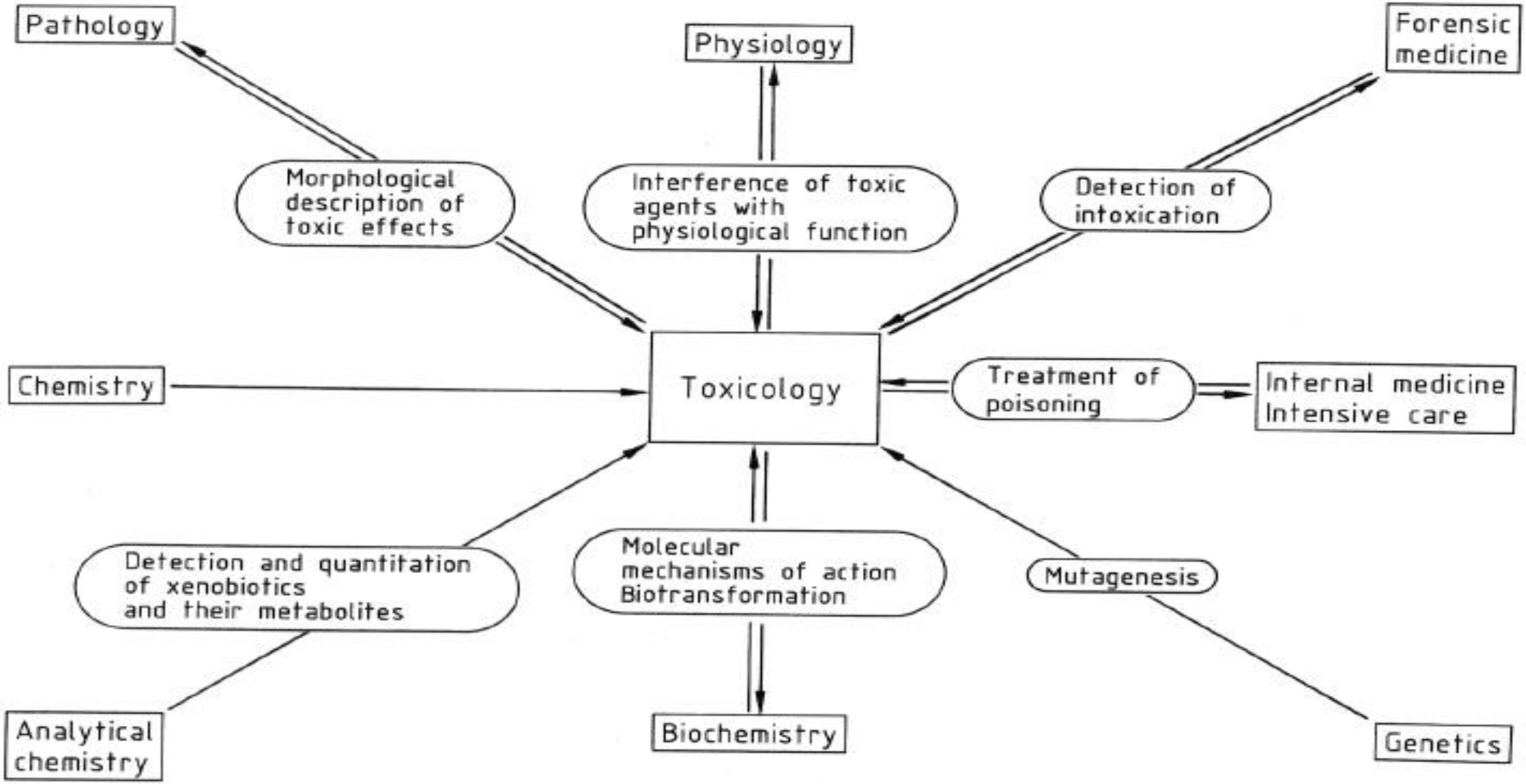


Figure 1. Scientific fields influencing the science of toxicology

Table 1. Areas of toxicology

Field	Tasks and objectives
Forensic toxicology	diagnoses poisoning by analytical procedures
Pesticide toxicology	studies the safety of pesticides, develops new pesticides
Occupational toxicology	assesses potential adverse effects of chemicals used in the workplace, recommends protective procedures
Drug toxicology	studies potential effects of drugs after high doses, elucidates mechanisms of sideeffects
Regulatory toxicology	develops and interprets toxicity testing programs and is involved in controlling the use of chemicals
Environmental toxicology	studies the effects of chemicals on ecosystems and on humans after low-dose exposure from the environment

-Mechanistic Toxicology.
-Toxico-genomics.
-Descriptive Toxicology.
-Eco Toxicology.
-Developmental Toxicology.
--Reproductive Toxicology

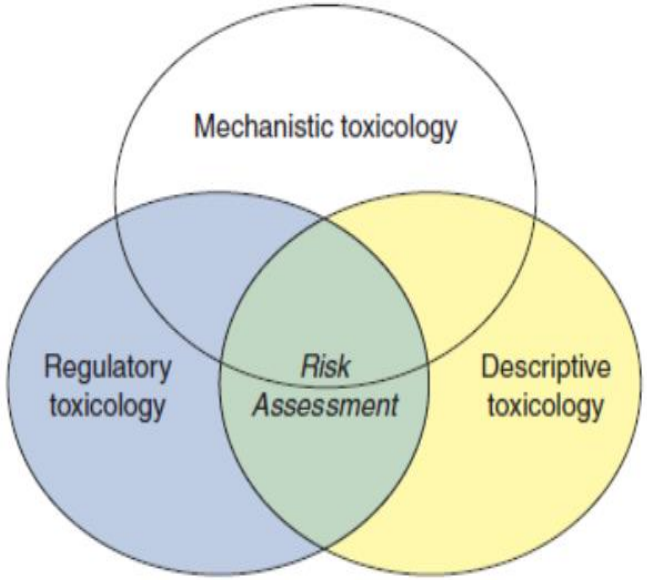


Figure 2-1. *Graphical representation of the interconnections between different areas of toxicology.*

- **DESCRIPTIVE ANIMAL TOXICITY TESTS**
- **Two main principles**
- **The first**
- is that the effects produced by a compound in laboratory animals,
- when properly qualified, are applicable to humans.
- This premise applies to all of experimental biology and medicine.
- On the basis of dose per unit of body surface, toxic effects in humans are usually in the same range as those in experimental animals.
- On a body weight basis, humans are generally more vulnerable than are experimental animals. When one has an awareness of these quantitative

  differences, appropriate safety factors can be applied to calculate

  relatively safe doses for humans.
- All known chemical carcinogens in humans, with the possible exception of arsenic, are carcinogenic in some species but not in all laboratory animals.
- **The second principle**
- is that exposure of experimental animals to chemicals in high doses is a necessary and valid method of discovering possible hazards in humans.
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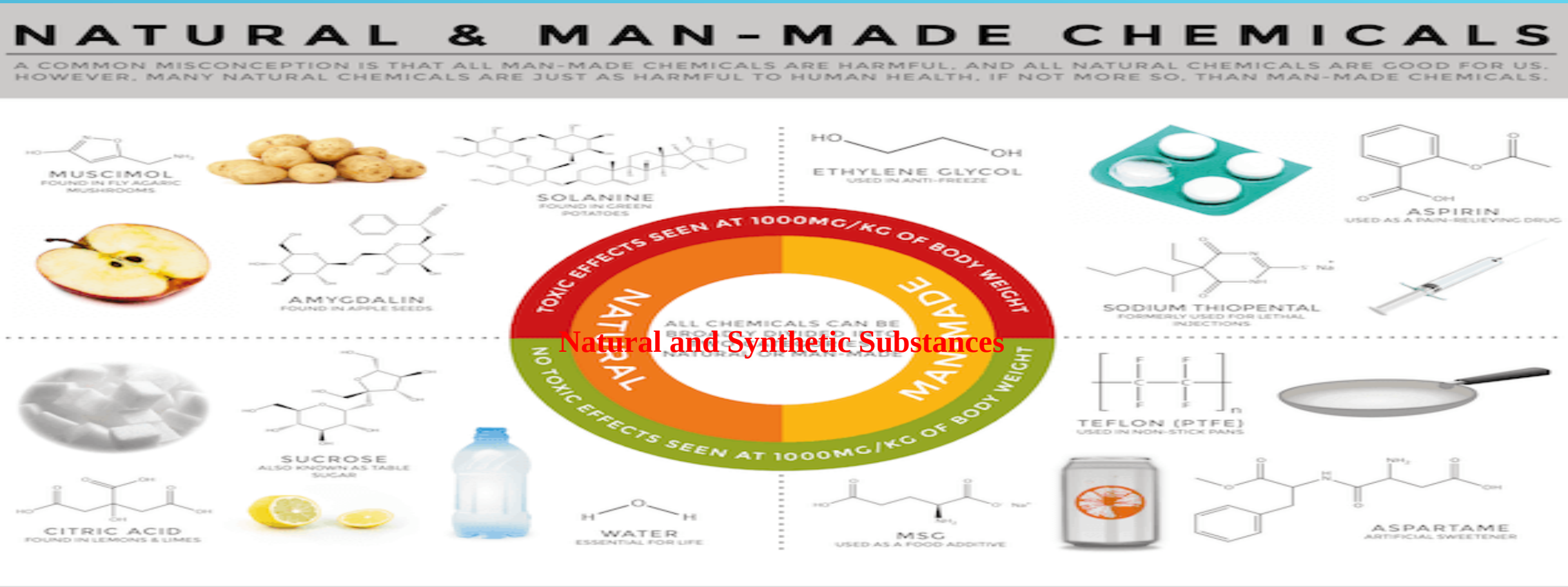
Natural and Synthetic Substances

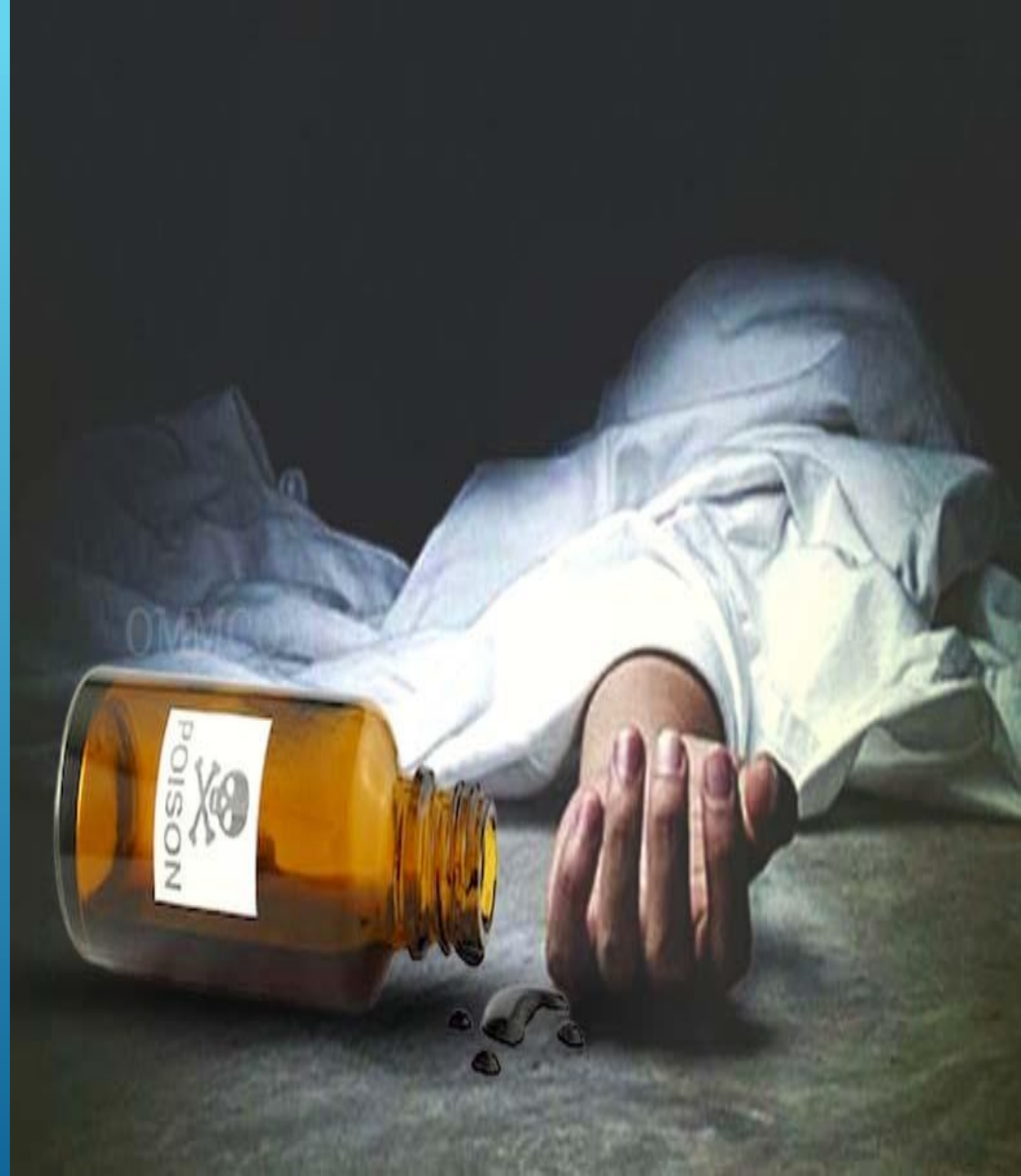


Natural and Synthetic Substances

- **Why would we make water in a lab?**
- Synthetic substances have advantages
- They may be cheaper or faster to produce. There are some hard-to-find chemicals. Or some natural chemicals that require a lot of purification in the lab (and this extra work comes with costs). Depending on the chemical it may be more cost-effective to make it in a lab, than to get out in nature in search for it. This is a very common case with vitamins. Many of the vitamins you see on the shelves are actually “synthetic” vitamins.

-*What is a poison?*

-*How poisons are classified ?*



Types of poisons

Agricultural chemicals

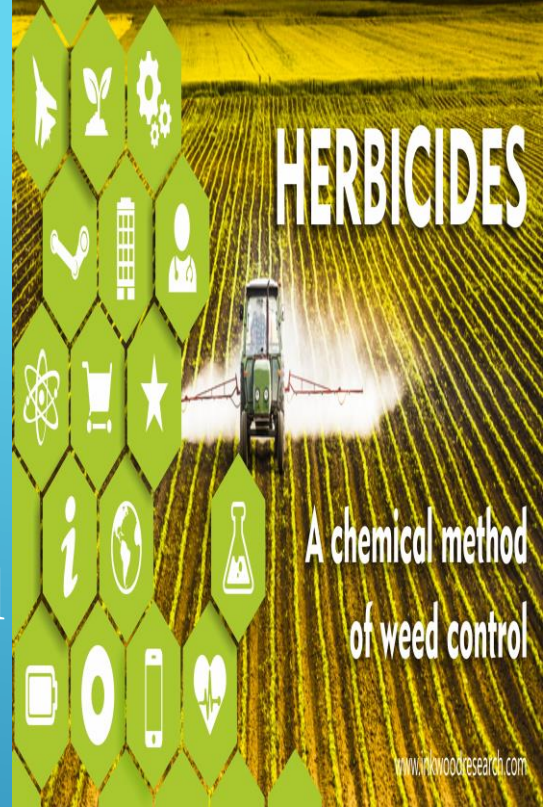
Majority of agricultural chemicals are pesticides, which include insecticides, herbicides, fungicides, fumigants, and rodenticides.

organophosphates, carbamates, chlorinated hydrocarbons, and insecticides derived from plants (botanical).
Organophosphate and carbamate insecticides act by inhibiting acetylcholinesterase, the enzyme that degrades acetylcholine (messenger of the parasympathetic nervous system).

As a result, acetylcholine levels remain high exaggerating the normal functions of the parasympathetic system (Table 1). Effects such as salivation, lacrimation, urination, defecation, twitching of the skeletal muscles, and in severe poisoning, death from respiratory depression occur.

Herbicides

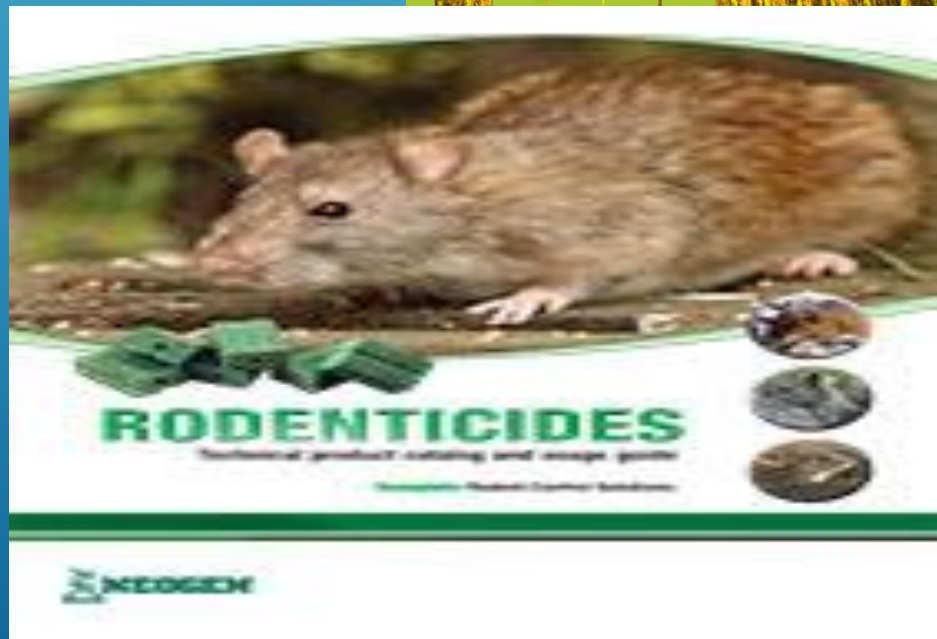
Herbicides are chemicals used to kill plants.



tetrachlorodibenzodioxin (TCDD), or dioxin. extremely toxic to some animals, it is less so to others, but it does cause birth defects and cancer in laboratory animals. The major toxicity of TCDD in humans is in the production of chloracne, a condition characterized by acne that appears between the eyes and the ears

Rodenticides

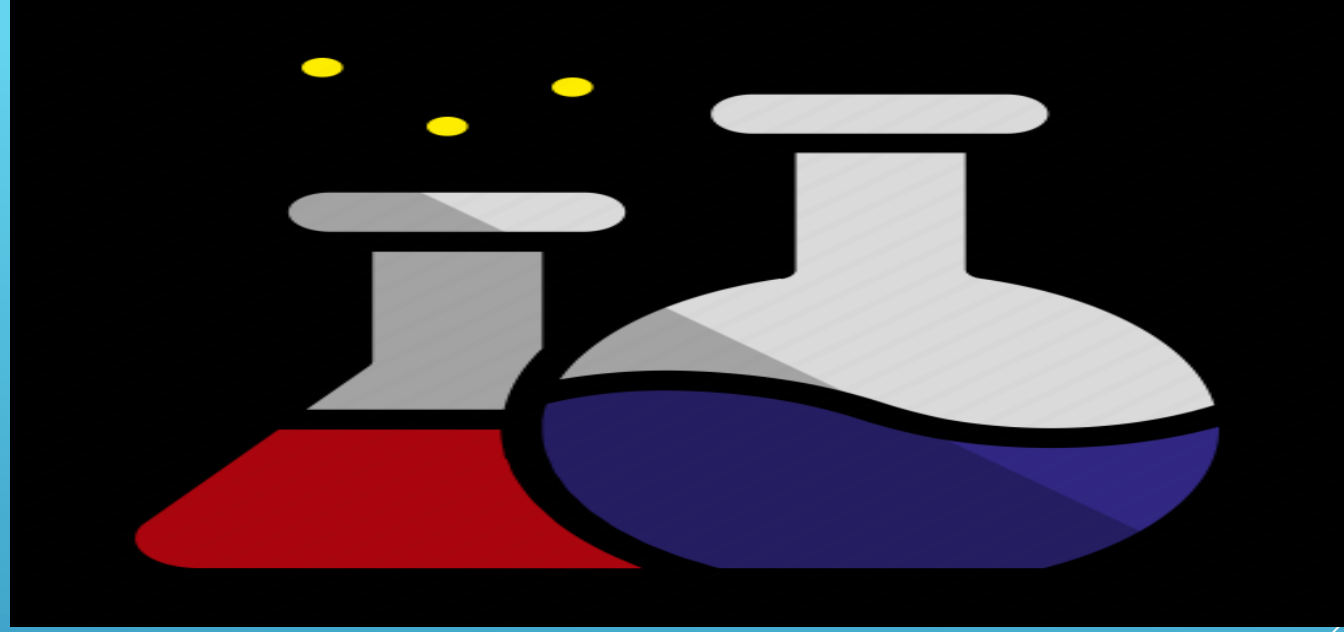
Warfarin



Industrial chemicals

Hydrocarbons.
Chlorinated hydrocarbons.
Alcohols.
Ketones.
Aromatic amines and nitro compounds
Miscellaneous inorganic compounds.
Air pollutants

Interaction of Chemicals



Interaction of Two Chemicals

Additive(2+3=5)

Synergistic(2+2=20)

Potentiation (0+2=10)

Isopropanol &CCl4.

Antagonistic(4+6=8),(4+(-4))=0

OR (4+0=1)

,

Toxins= (Greek:Toxikon),

Poisons of biological origin (Biotoxins)

(1) microbial toxins,
(2) phytotoxins, poisons produced by plants,

(3) zootoxins, poisons produced by animals.

Biotoxins

may also function as defensive mechanisms, as in some snakes, fishes, arthropods (e.g., insects, millipedes), and others. The defense may be quite complex—as in the protection of territorial rights for reproductive purposes—and inhibitory or antibiotic substances may be produced that result in the exclusion of competitive animal or plant species.

biotoxins play important roles in the regulation of natural populations.

Importance to humans

Venom-producing animals and stinging and dermatogenic plants capable of inflicting pain and sometimes death by means of parenteral contact (i.e., by bringing poisons into the body other than through the digestive tract) constitute environmental hazards.

Biotoxic agents produce injurious effects

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An example is that of the shore fishes of many tropical islands; otherwise valuable food fishes are frequently contaminated by a poison called ciguatoxin. The poison, a potent neurotoxin (nerve poison), is accidentally ingested by the fishes in their food; such fish can no longer be used for either human or animal consumption.