RAMA UNIVERSITY

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FACULTY OF ENGINEERING & TECHNOLOGY

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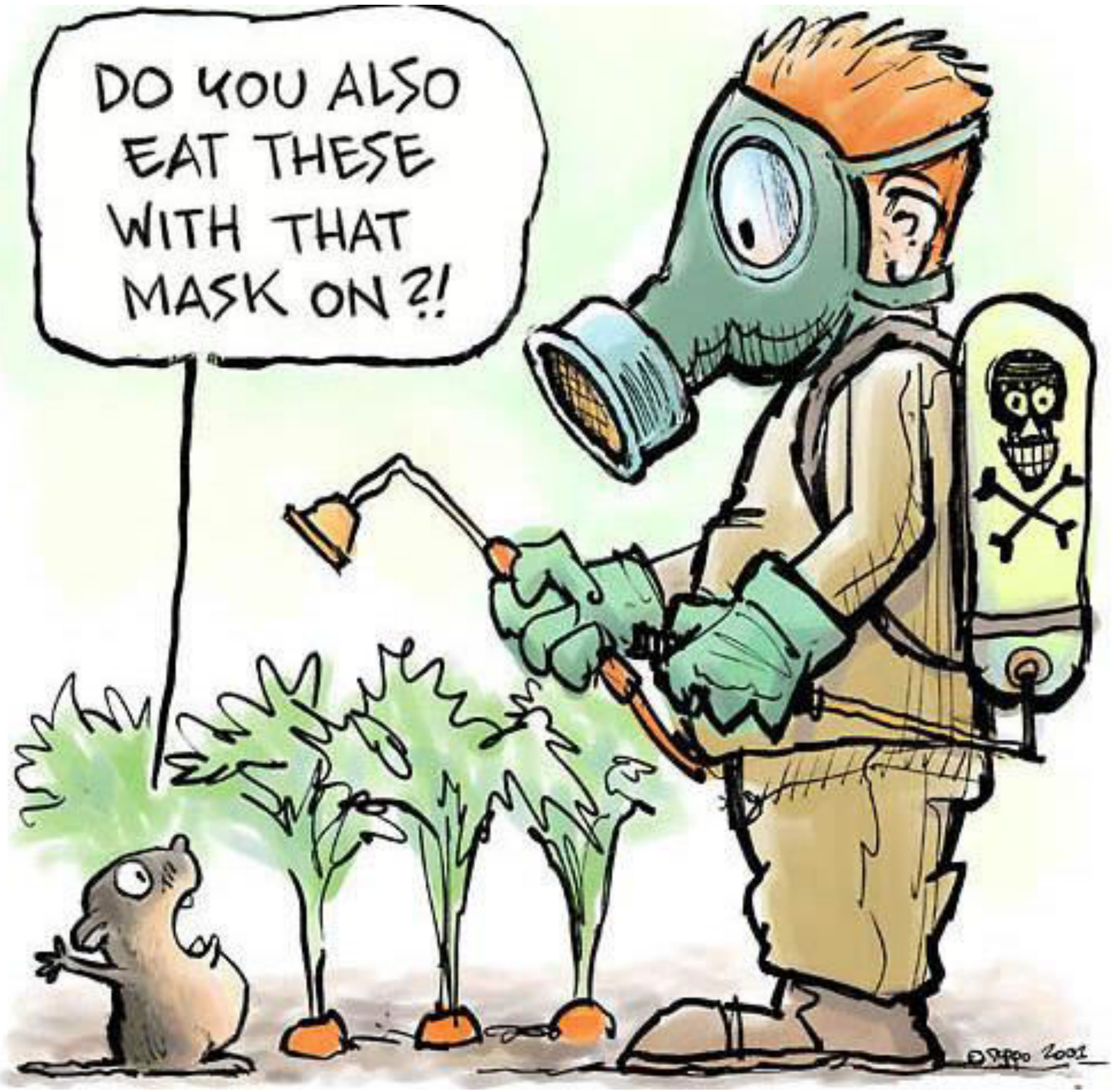
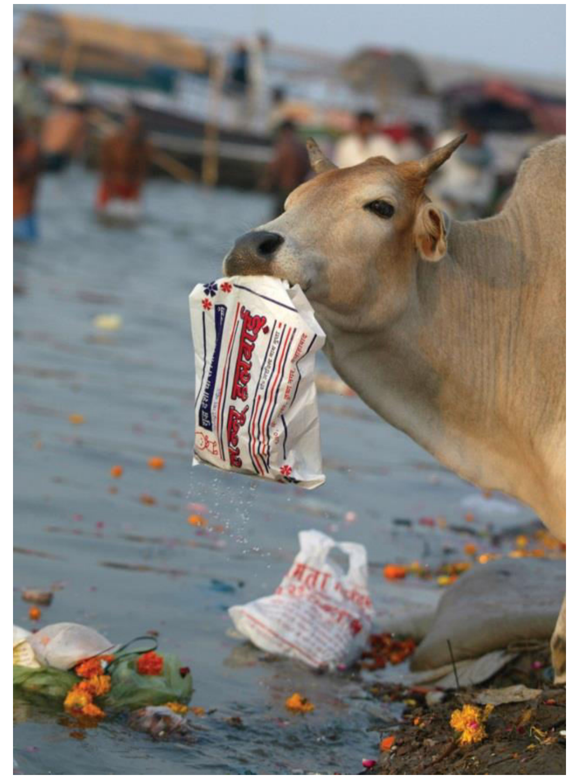

DO YOU ALSO EAT THESE WITH THAT MASK ON ?!



Plastic bags	10–20 years
Soft plastic (bottle)	100 years
Hard plastic (bottle cap)	400 years


انگلش سیکھنے کا مستند
LI
ڈپلومہ ان جنرل انگلش
بیسک 2 ایڈوانس

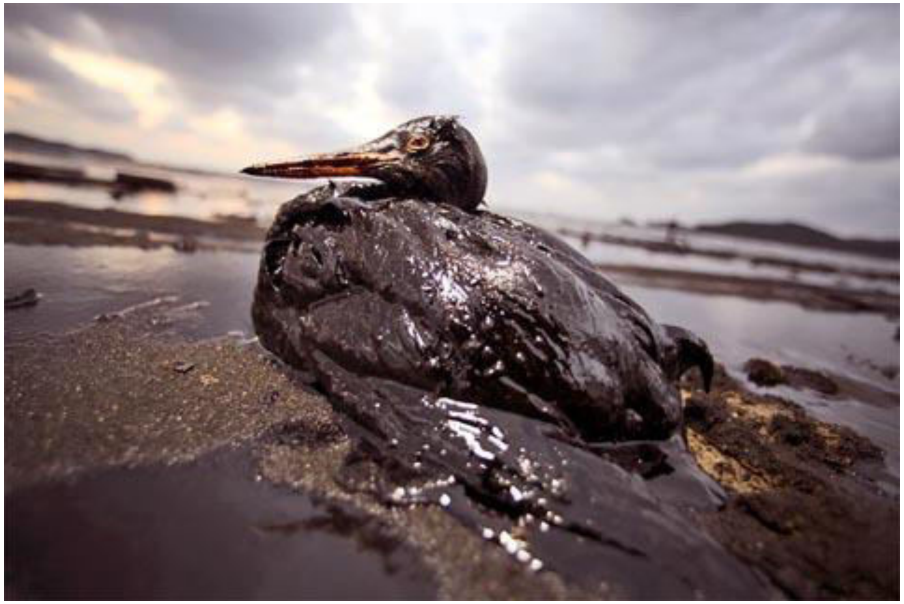


The people, especially the youth, are buying ‘E-Waste of the West’ as branded computers due to lack of awareness about the grave risks it is posing to the environment, human life and animals.

Composition of a Desktop Computer with a CRT screen

Range of Amount Present	Materials
4-7 Kg	Aluminum, iron, plastics, silica (glass)
1.5-2 Kg	Lead, copper
0.25-0.5 Kg	Nickel, tin, zinc
< 0.1Kg	**(~550 g)** Antinomy, beryllium, barium, cobalt, cadmium, manganese, tantalum, titanium, silver. **(~125g))** Yttrium, bismuth, chromium, arsenic, mercury. **(~50 g)** Indium, gallium, germanium, gold, ruthenium, selenium. **(~ 5-6 g)** Europium, niobium, vanadium , palladium



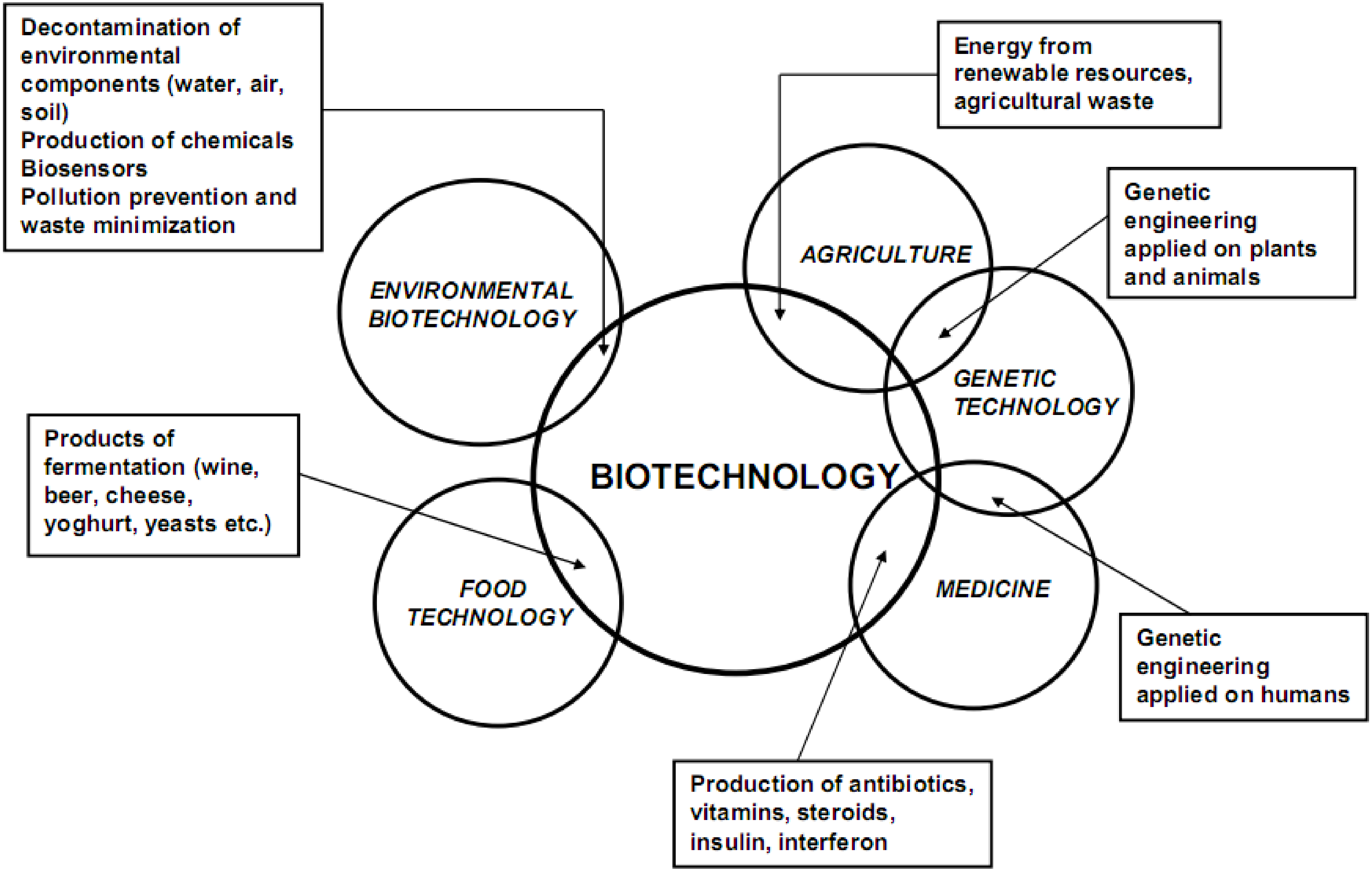



Pollution??

- Pollution is the introduction of contaminants into the natural environment that cause adverse change.
- Pollutants, the components of pollution

Important Definitions

- Biotechnology?
- "Any technique that uses living organisms or substances from those organism, to **make** or **modify** a product, to improve plant or animals, or to develop microorganism for **specific uses**"
- Thus biotechnology encompasses
  - Tools and techniques
  - Living organism i.e. plant, animal or microorganism
  - Products from these organism can be new or rare


Decontamination of environmental components (water, air, soil)
Production of chemicals
Biosensors
Pollution prevention and waste minimization
Energy from renewable resources, agricultural waste
Genetic engineering applied on plants and animals
ENVIRONMENTAL BIOTECHNOLOGY
AGRICULTURE
GENETIC TECHNOLOGY
BIOTECHNOLOGY
Products of fermentation (wine, beer, cheese, yoghurt, yeasts etc.)
FOOD TECHNOLOGY
MEDICINE
Genetic engineering applied on humans
Production of antibiotics, vitamins, steroids, insulin, interferon

Important Definition

- Green Biotechnology
- Red Biotechnology
- White Biotechnology
- Blue Biotechnology

Environmental Biotechnology

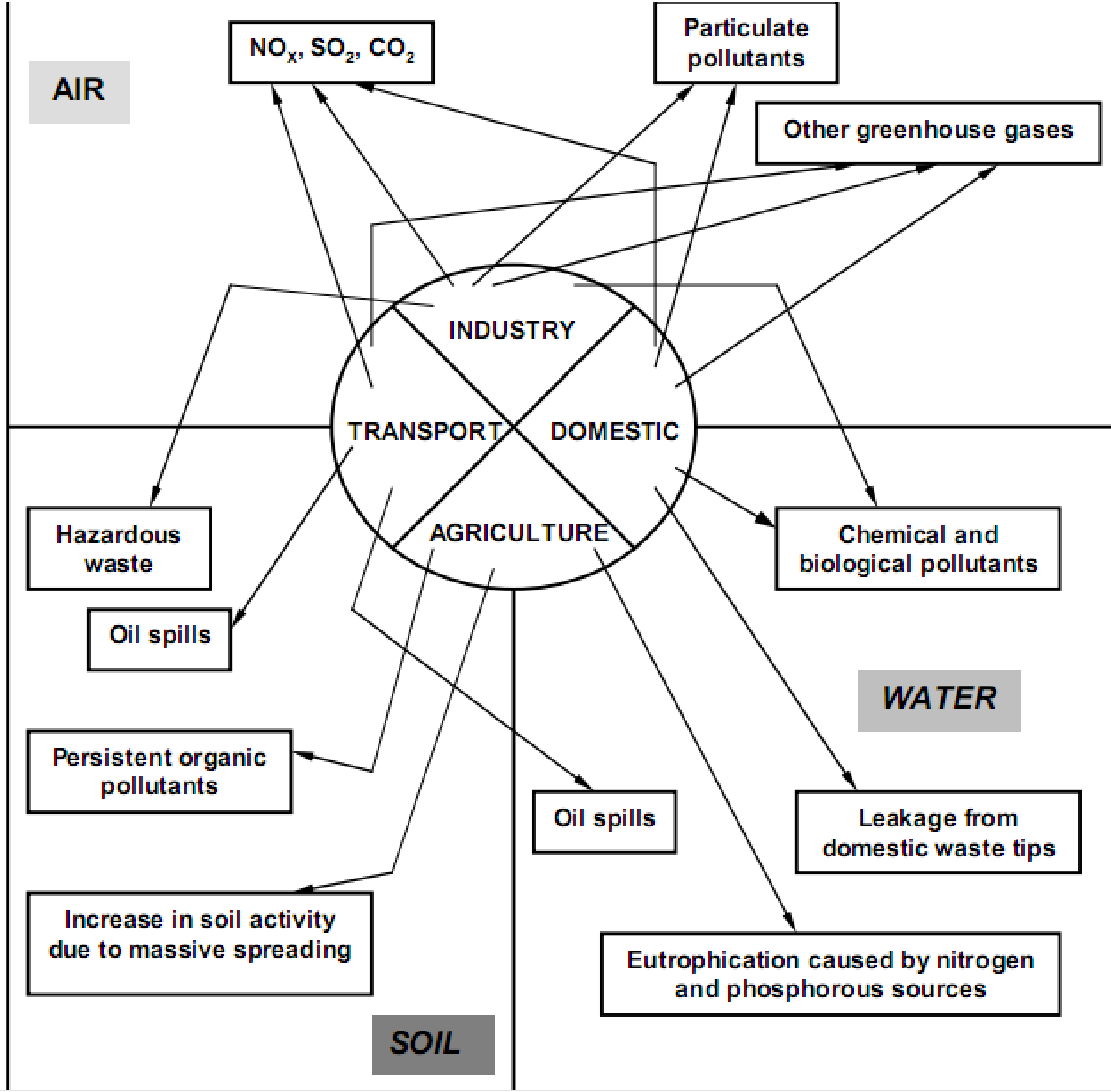
- It deals with **pollution diagnostics**, products for **pollution prevention**, **bioremediation**

- It is assisted by various disciplines, such as
  - Biochemical bioprocesses and biotechnology engineering,
  - Genetic engineering,
  - Protein engineering, metabolic engineering,

Environmental Biotechnology

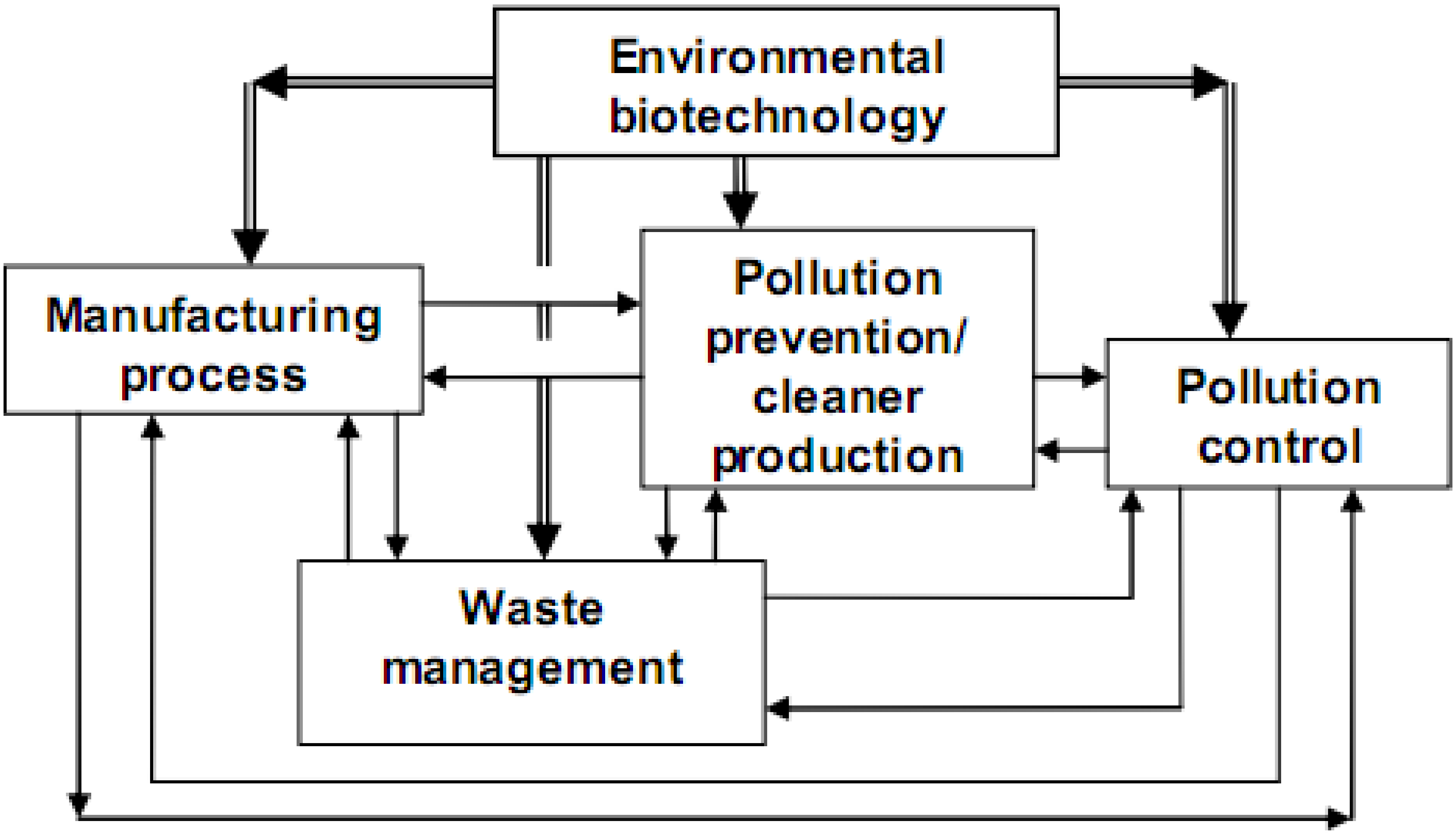
- Environmental Biotechnology has evolved from chemical engineering, but later, other disciplines i.e.
- Biochemistry,
- Environmental engineering,
- Environmental microbiology,
- Molecular biology,
- Ecology

Pollution



AIR
NOx, SO2, CO2
Particulate pollutants
Other greenhouse gases
INDUSTRY
TRANSPORT
DOMESTIC
AGRICULTURE
Hazardous waste
Oil spills
Chemical and biological pollutants
WATER
Persistent organic pollutants
Oil spills
Leakage from domestic waste tips
Increase in soil activity due to massive spreading
Eutrophication caused by nitrogen and phosphorous sources
SOIL

Environmental Biotechnology



Key intervention points of environmental biotechnology

Bio-treatment/Bioremediation

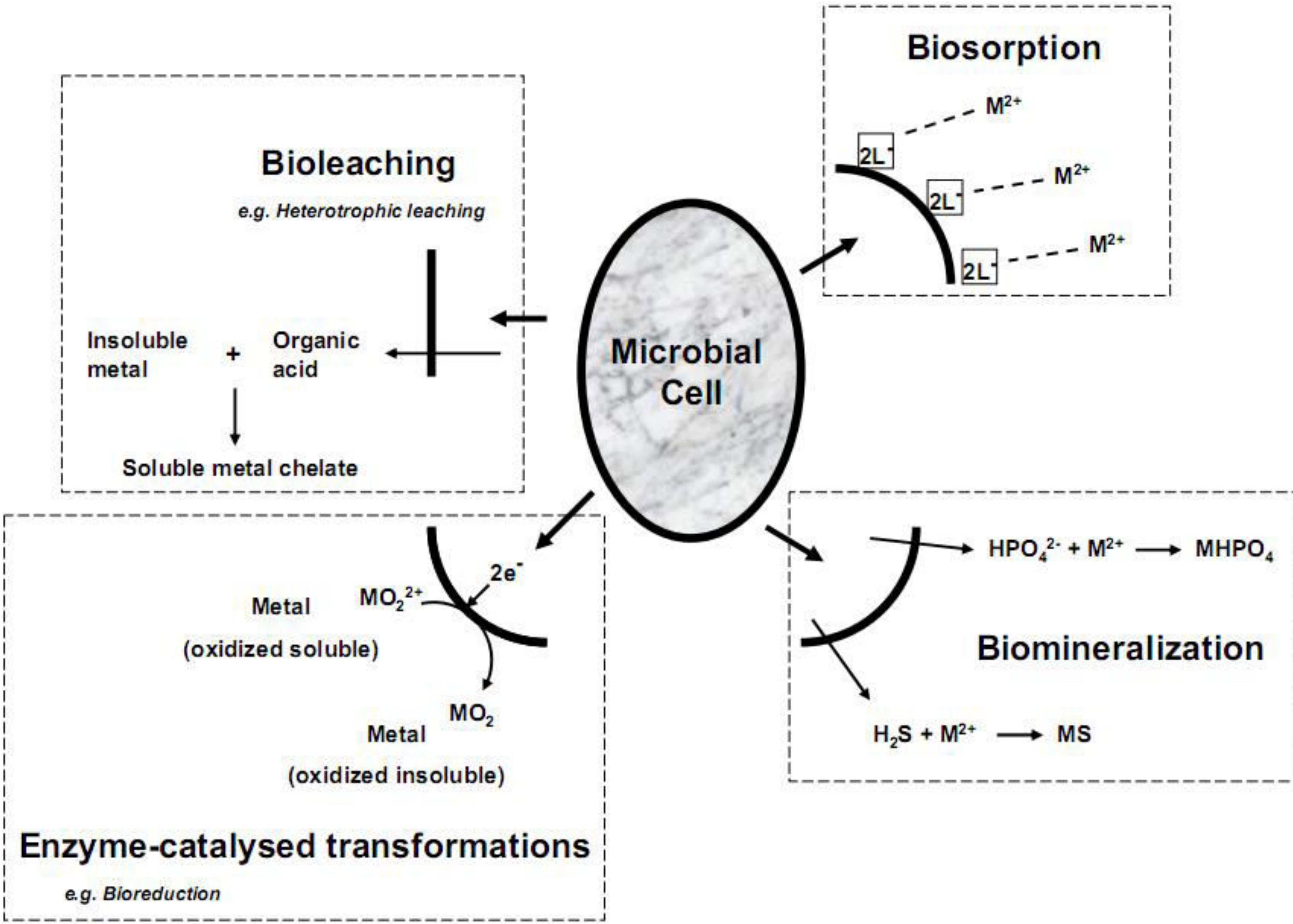
- **Bioremediation** is the use of micro-organism metabolism to remove pollutants
  - These methods are almost typical “end-of-pipe processes” applied to remove, degrade, or detoxify pollution in environmental

Bioremediation

- Removal/ separation: a process that removes the contaminant from the host medium
- Destruction/degradation: a process that chemically or biologically destroys or neutralizes the contaminant to produce less toxic compounds
- Containment/immobilization: a process that impedes or immobilizes the surface and subsurface migration of the contaminant

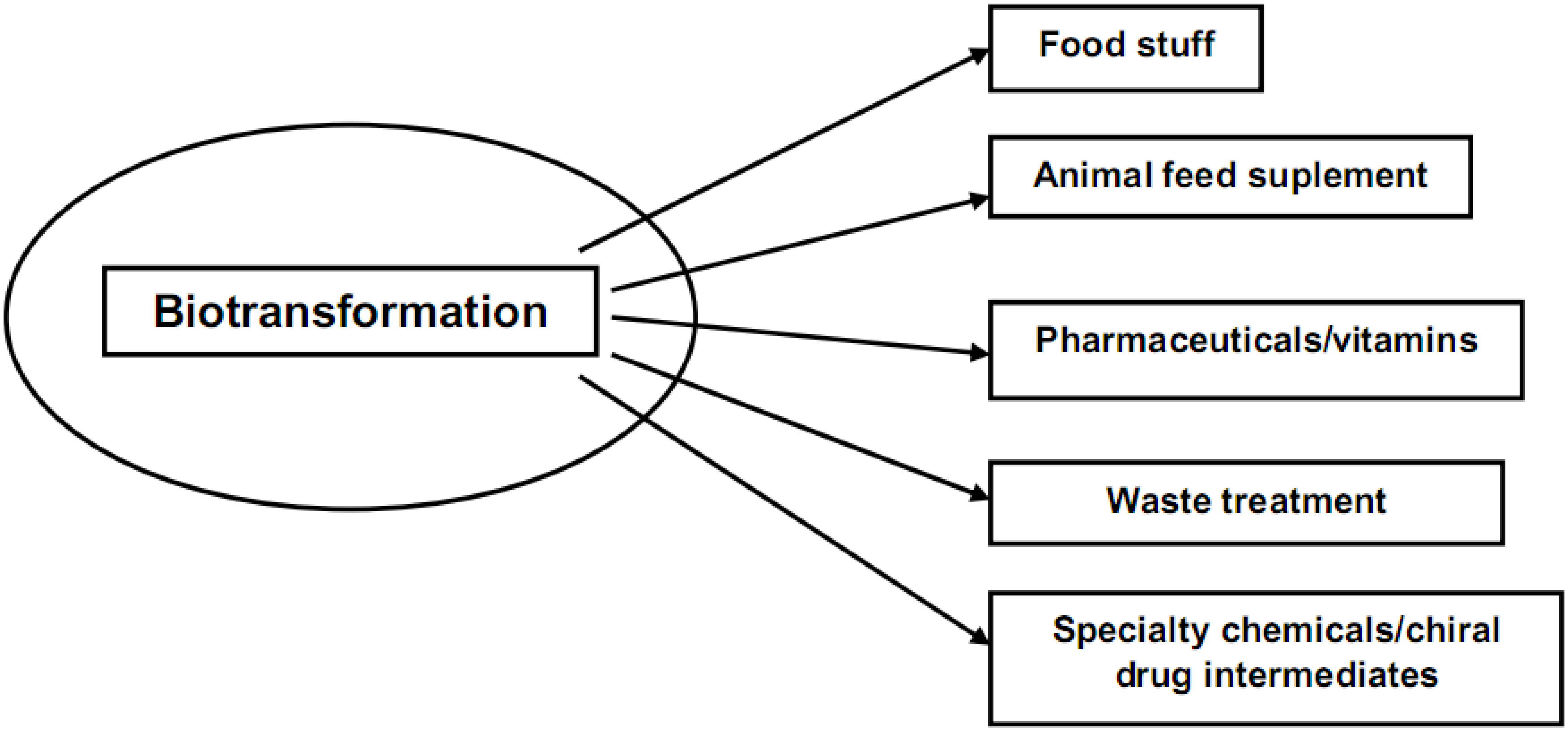
Microorganisms and processes

- **Bacteria:**
  - (requires sufficient oxygen: *Pseudomonas*, *Alcaligenes*, *Sphingomonas*, *Rhodococcus*, *Mycobacterium*)
  - degrade pesticides and hydrocarbons, both alkanes and poly-aromatic compounds
  - bacteria use the contaminant as the sole source of carbon and energy
  - it is a faster process
  - anaerobic bacteria are used for bioremediation of polychlorinated biphenyls (PCBs) in river sediments, de-chlorination of the solvent trichloroethylene (TCE), chloroform
- **Ligninolytic fungi:**
  - have the ability to degrade an extremely diverse range of persistent or toxic environmental pollutants (as white rot fungus *Phanaerochaete* ***chrysosporium****)*
- **Methylotrophs**
  - grow utilizing methane for carbon and energy
  - are active against a wide range of compounds, including the chlorinated aliphatics trichloroethylene and 1,2-dichloroethane DDT

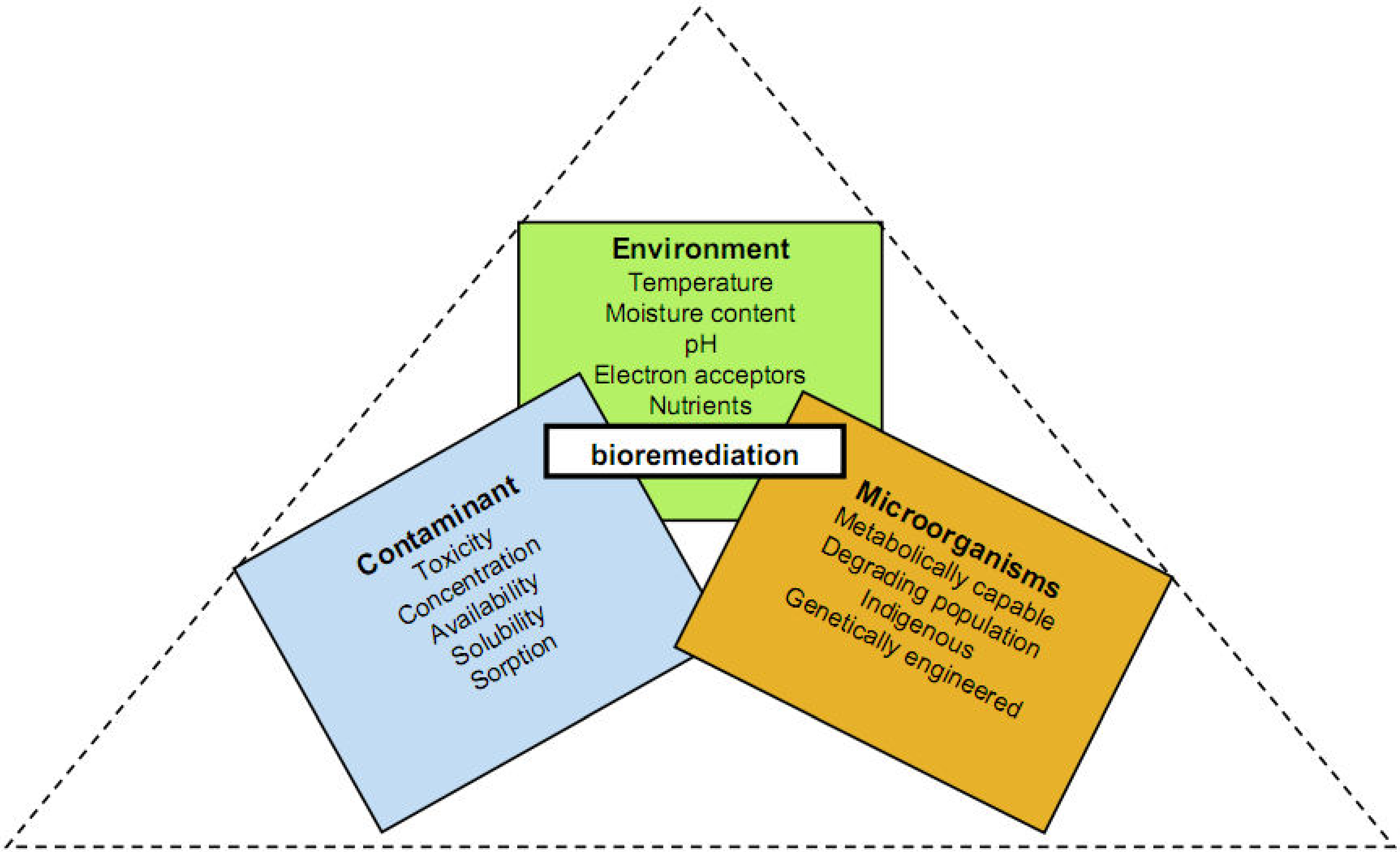


Biosorption
2L⁻
M2+
Bioleaching
e.g. Heterotrophic leaching
Insoluble metal
+
Organic acid
Soluble metal chelate
Microbial Cell
2e-
Metal
MO2 2+
(oxidized soluble)
MO2
Metal
(oxidized insoluble)
Enzyme-catalysed transformations
e.g. Bioreduction
HPO4 2- + M2+ → MHPO4
Biomineralization
H2S + M2+ → MS

Biotransformation



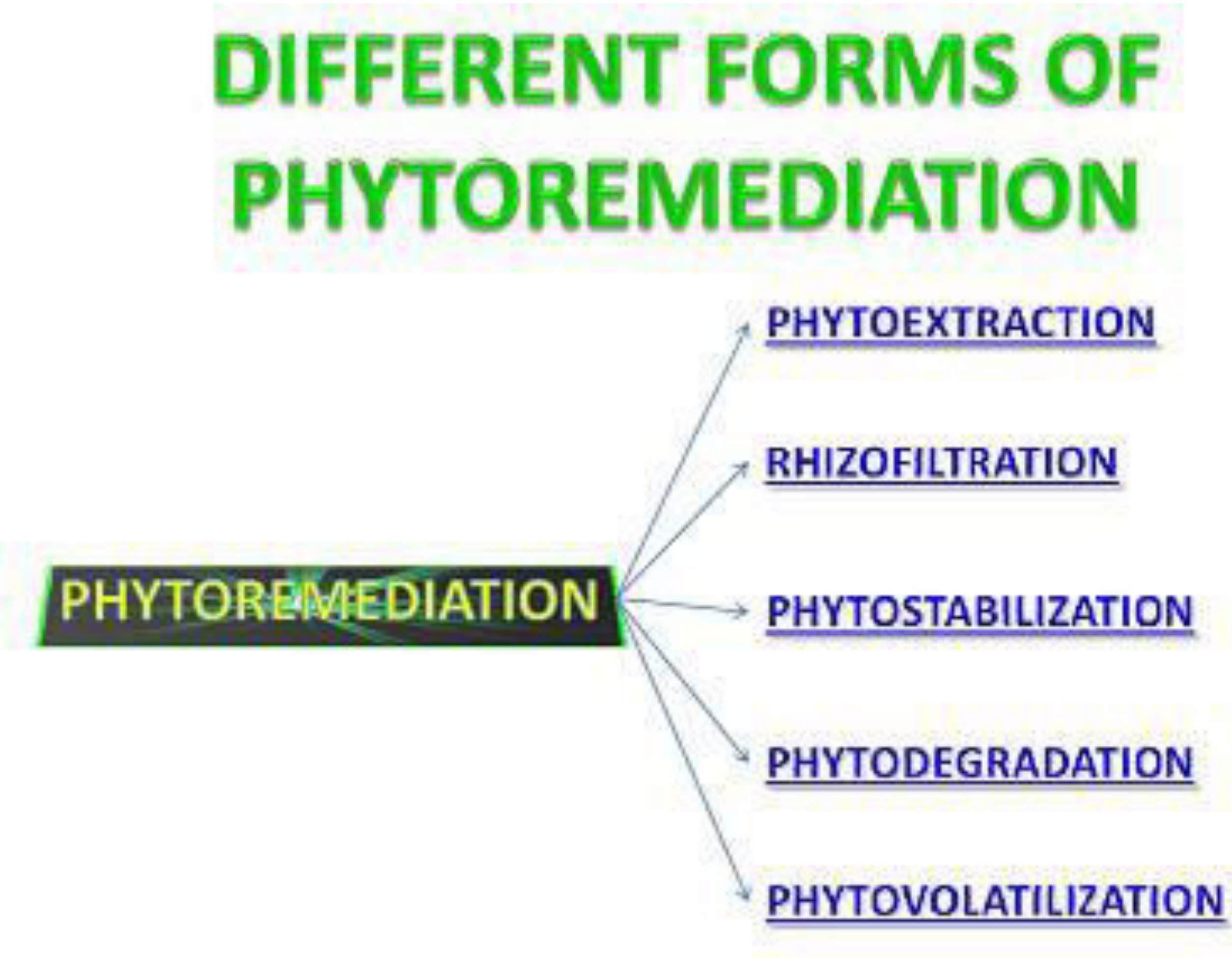
Factors Influencing Bioremediation



Chromium (VI) from Leather Tanneries

- Chromium is a toxic heavy metal that is widely used in electroplating, leather tanning, textile dyeing, and metal processing industries.
- European Union recommends total chromium limits of 0.05 and 0.1 mg/L for potable and industrial wastewater respectively
- Many microorganisms have been reported to reduce the highly soluble and toxic Cr(VI) to the less soluble and less toxic Cr(III), e.g., *Acinetobacter, Arthrobacter, Pseudomonas sp*.

Phytoremediation



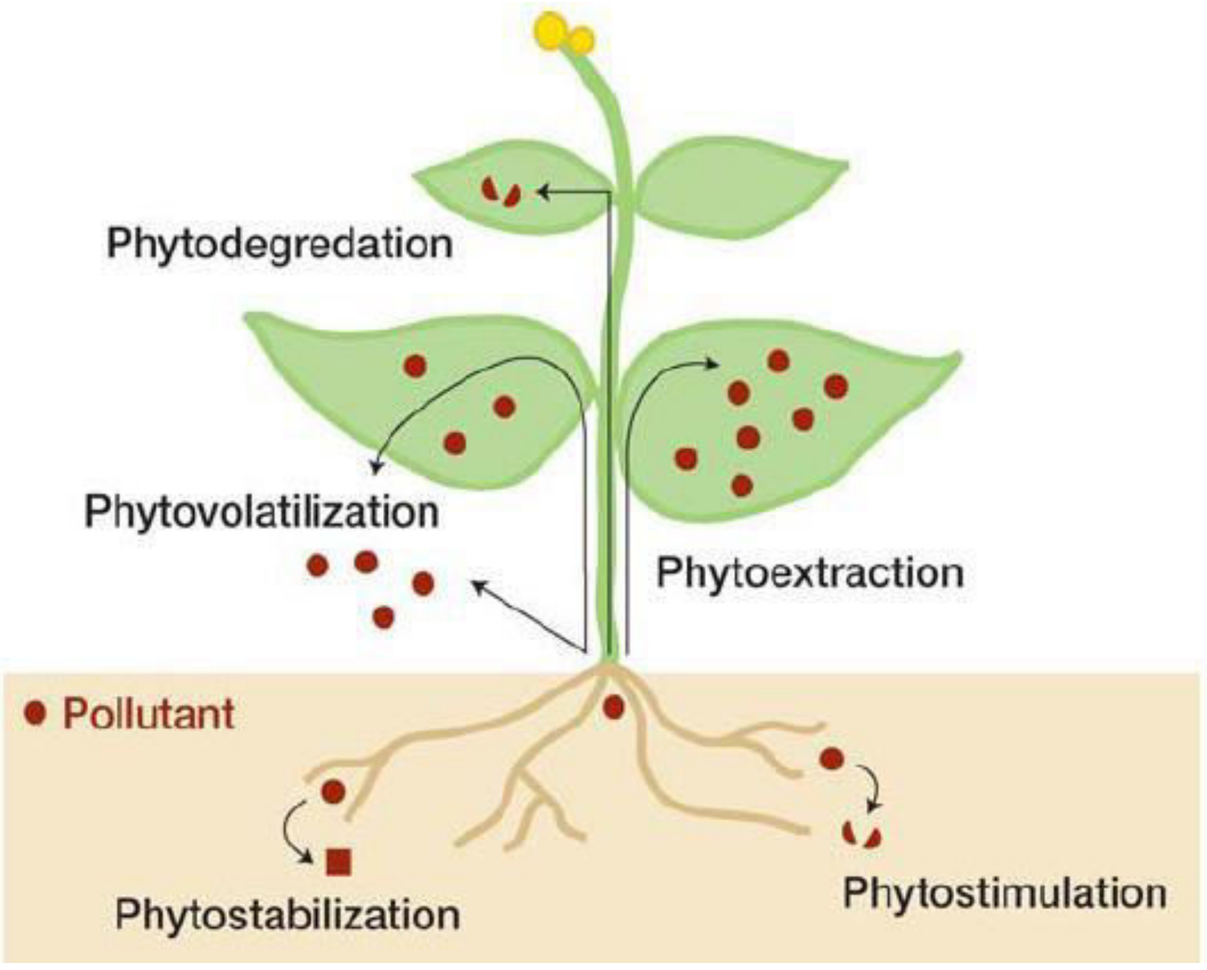
Methods of phytoremediation

- **Phytoextraction or phytoaccumulation**
  - the plants accumulate contaminants into the roots and aboveground shoots or leaves
  - produces a mass of plants and contaminants (usually metals) that can be transported for disposal or recycling
- **Phytotransformation or phytodegradation**
  - uptake of organic contaminants from soil, sediments, or water and, subsequently, their transformation to more stable, less toxic, or less mobile form
- **Phytostabilization**
  - plants reduce the mobility and migration of contaminated soil
  - leachable constituents are adsorbed and bound into the plant structure so that they form a stable mass of plant from which the contaminants will not reenter the environment

Methods of phytoremediation

- **Phytodegradation or rhizodegradation**
  - breakdown of contaminants through the activity existing in the rhizosphere, due to the presence of proteins and enzymes produced by the plants or by soil organisms such as bacteria, yeast, and fungi
  - is a symbiotic relationship that has evolved between plants and microbes: plants provide nutrients necessary for the microbes to thrive, while
  - microbes provide a healthier soil environment
- **Rhizofiltration**
  - is a water remediation technique that involves the uptake of contaminants by plant roots
  - is used to reduce contamination in natural wetlands and estuary area
- **Phytovolatilization**
  - plants evaportranspirate selenium, mercury, and volatile hydrocarbons from soils and groundwater

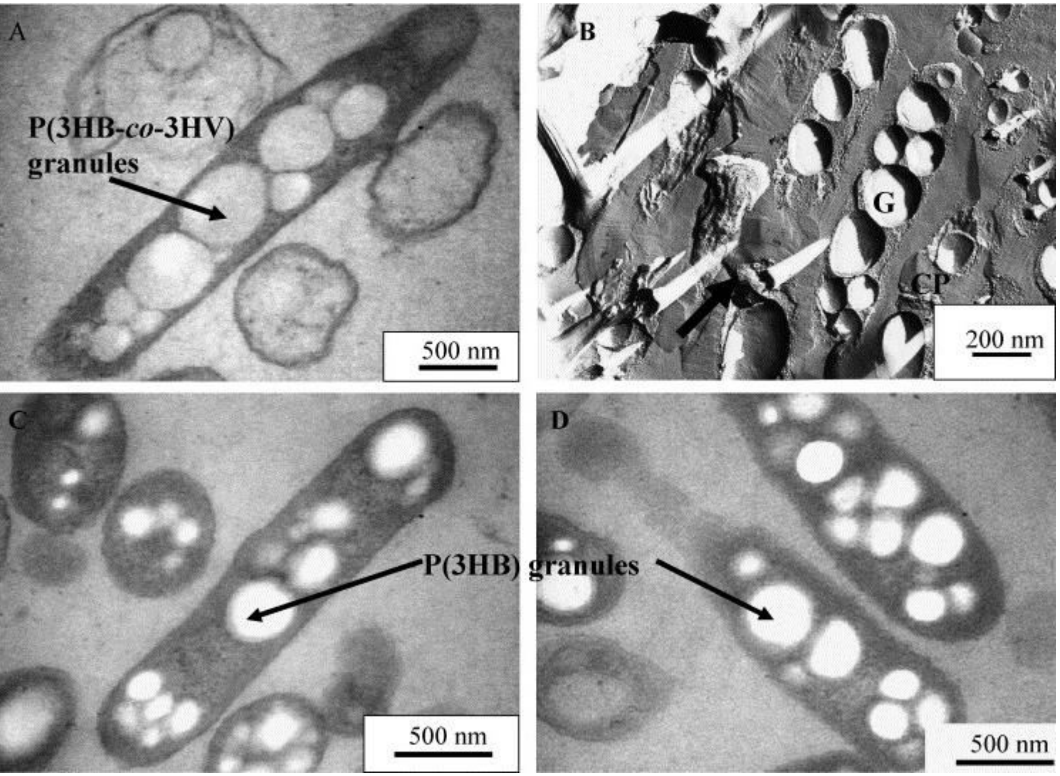
Phytoremediation



Phytoremediation

LARGE-SCALE PHYTOREMEDIATION SYSTEMS IN SWEDEN

Bio-Plastic (Biodegradable Plastic)



Bio-Plastic (Biodegradable Plastic)

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Screening for polyhydroxyalkanoate (PHA)-producing bacterial strains and comparison of PHA production from various inexpensive carbon sources

Waqas Nasir Chaudhry, Nazia Jamil, Iftikhar Ali, Mian Hashim Ayaz, Shahida Hasnain

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Abstract

A total of 20 different strains were isolated, purified and screened for polyhydroxyalkanoate (PHA) production. PHA-producing strains were screened by Nile blue staining and confirmed by Sudan Black B staining. Strain 1.1 was selected for further analysis due to its high PHA production ability. PHA production was optimized and time profiling was calculated. PHA production on various different cheap carbon sources, i.e., sugar industry waste (fermented mash, molasses, spent wash) and corn oil, was compared. Cell dry weight and PHA content (%) were calculated and compared. The 12.53 g/L is the CDW of bacterial strain when grown in medium containing corn oil. It was found that corn oil at 12.53 g/L medium can serve as a carbon source for bacterial growth, allowing cells to accumulate PHA up to 35.63 %. The *Pha*C gene was amplified to confirm the genetic basis for the production of PHAs. Moreover, 16S rRNA gene sequence analysis showed that strain 1.1 belongs to

Ensolve Biosystems, Inc.

COMPOST EQUIPMENT

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BIOWORLD PRODUCTS

Engg, Environmental, Labs & Medical ELM SERVICES

THINK AND ACT GREEN

THINK GREEN