



Environmental Improvements Achieved by Microbiology

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What it is...



- *The study of how microorganisms affect the earth and its atmosphere is called environmental microbiology or microbial ecology.

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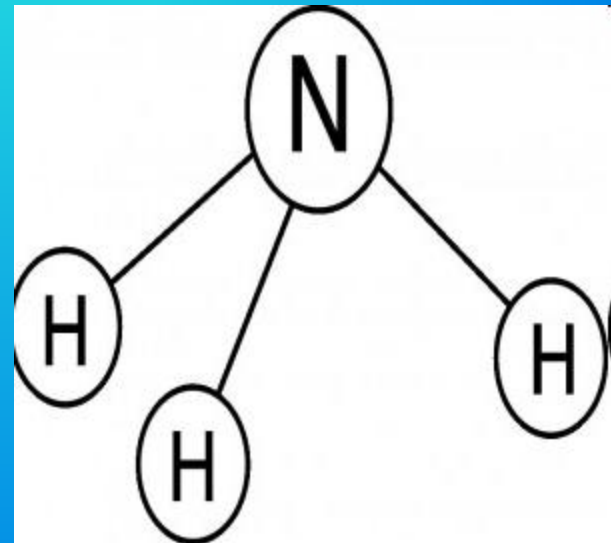
- Many types of microbes remain unknown. It is estimated that we know fewer than 1% of microbial species on earth.
- *Microbes are everywhere-
soil, water, air, etc.
- *An average grain of soil contains 1 billion microbes varying from many different species

Technology Involved..

- *CANON system (completely autotrophic nitrogen-removal over nitrite)
- Can remove ammonium from wastewater in a single, oxygen limited treatment
- It relies on only 2 bacterial populations-
Nitrosomonas-like aerobic and
Planctomycete-like anaerobic ammonium oxidising bacteria.

CANON system...

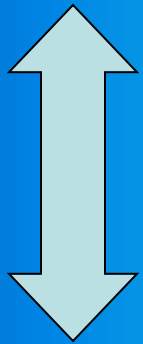
- This technological system is beneficial because ammonia is a substance that could kill humans if ingested or inhaled.



Example of an ammonia molecule

Terms to know...

Pseudomonas

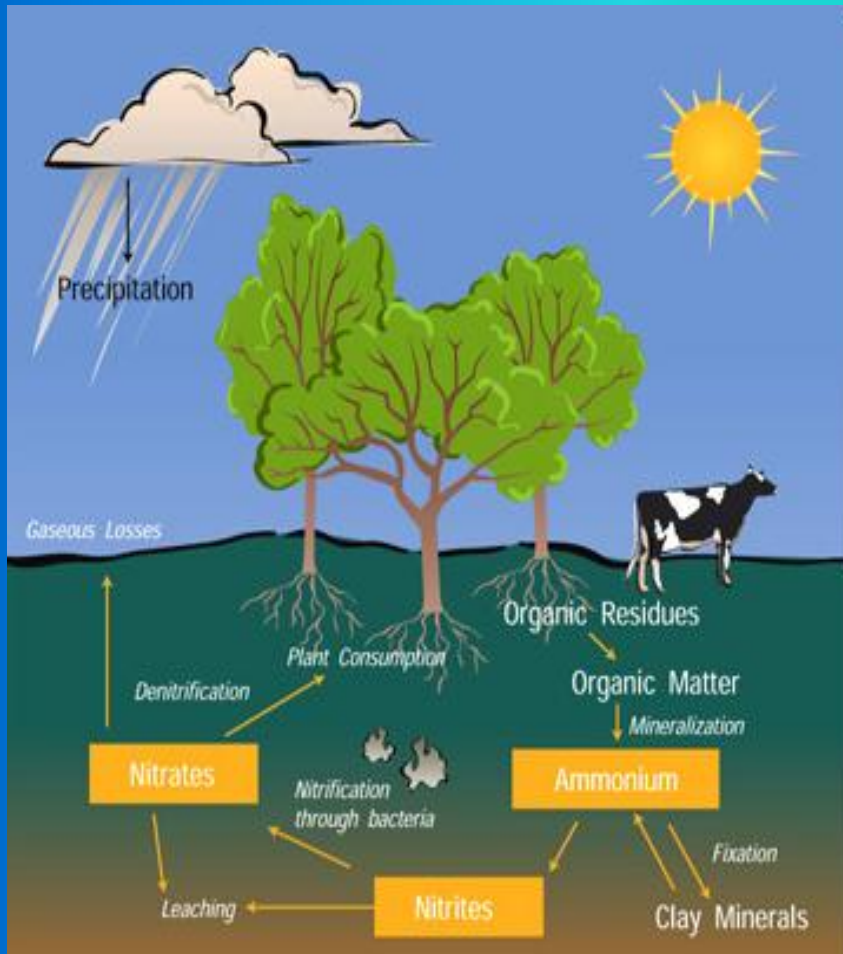


* Fungi



- *Decomposers break down dead organisms into nutrients to nourish the plant.

Nitrogen Cycle

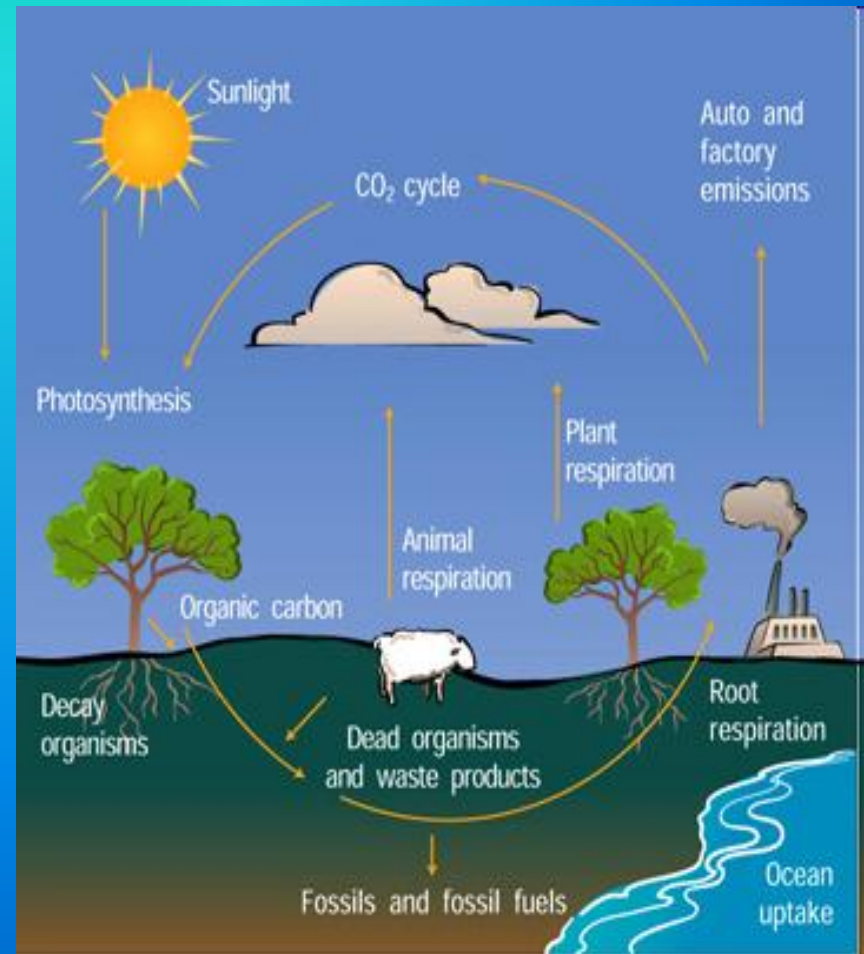


- This cycle is important to the environment because nitrogen makes up 78% of our air.
- Proteins, nucleic acids, and other organic materials contain nitrogen

Autumn

Carbon Cycle

- *It moves carbon back in forth from oceans to atmospheres.
- Scientists have said that an imbalance between the two of these things may be a partial cause to global warming



Oil Biodegradation

- Oil spills have caused many ecological problems over the years.
- *Scientists have found that hydrocarbonoclastic bacteria can actually degrade oil. This is especially beneficial to the marine life that has been effected by oil spills.

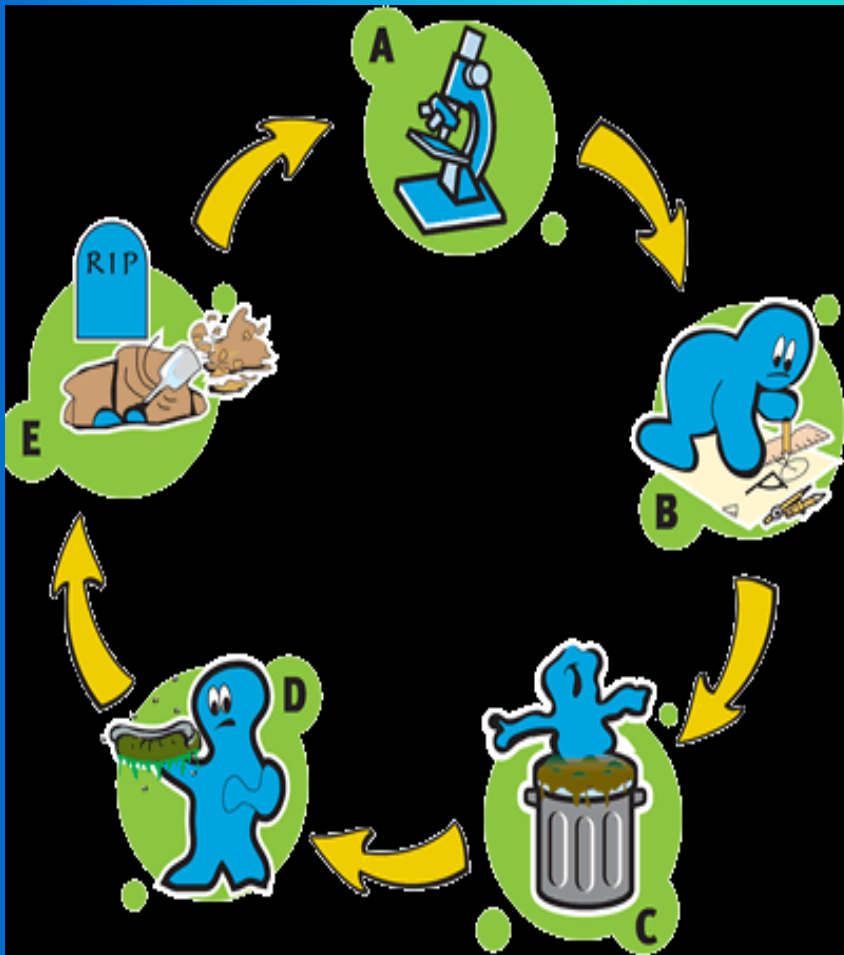


Waste biotreatment

- Waste biotreatment is the processing of hazardous substance using living organisms such as fungi, protozoa, and bacteria. *It is environmental friendly and cost effective



Bioremediation...



- *The use of microorganism metabolism to remove pollutants.
- The two types are *in situ* or *ex situ*.
- In situ involves treating the contaminated material at the site
- Ex situ involves removal of the contaminate and treating it else where.

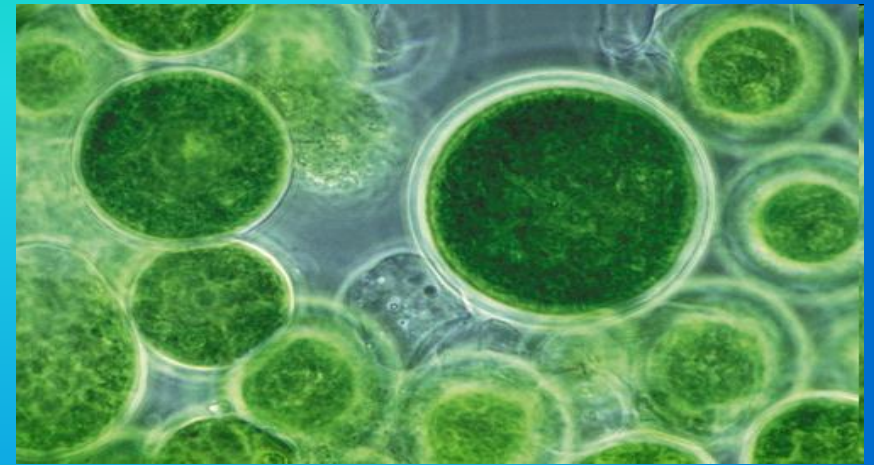
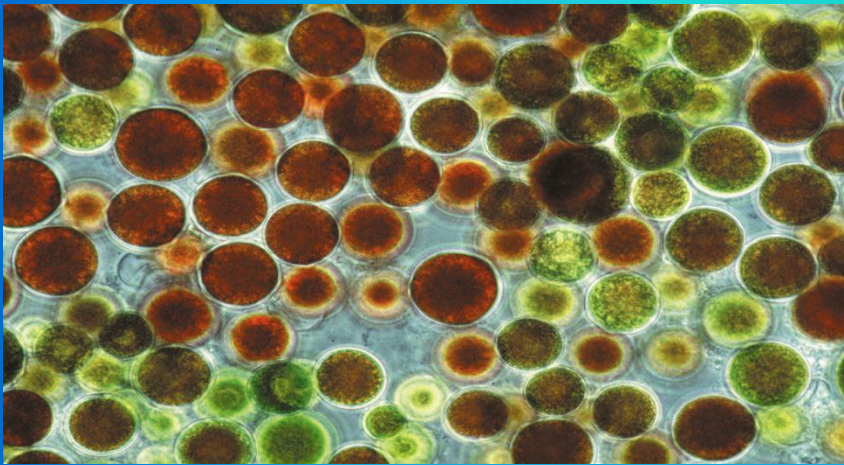
Bioremediation...

- Some examples of bioremediation technologies are phytoremediation, bioventing, bioleaching, landfarming, bioreactor, composting, bioaugmentation, rhizofiltration, and biostimulation.
- **Phytoremediation** describes the treatment of environmental problems through the use of plants that mitigate the environmental problem without the need to excavate the contaminant material and dispose of it elsewhere.

Bioremediation

- **Land Farming** is a bioremediation treatment process that is performed in the upper soil zone or in biotreatment cells. Contaminated soils, sediments, or sludges are incorporated into the soil surface and periodically turned over (tilled) to aerate the mixture.
- **Rhizofiltration** is a form of bioremediation that involves filtering water through a mass of roots to remove toxic substances or excess nutrients.

Microalgae



- *Algae are groups of protists that are found in any aquatic system. They supply carbon and oxygen on top of habitats for other microorganisms.

How do they benefit everyday life?

- Gulf oil spills have been eaten by certain bacterias.
- Bacteria eats pollution and generates electricity.
- Plastic eating bacteria that breaks down bags.
- Nylon eating bacteria clean up factory waste.
- Turning newspapers into car fuel.
- Soil dwelling bacteria kills cancer.
- Panda's poop bacteria makes biofuel.
- Turning human waste into rocket fuel.
- Sulphur eating bacteria reduce acid run off.
- Probiotic bacteria that treat depression and anxiety.

*Plastic eating bacteria that break down bags.

- In 2008, a student conducted an experiment where he found some bacteria can break down plastic bags.



*Turning human waste into rocket fuel

- The bacteria *Brocadia anammoxidans*, can transform human sewage into hydrazine which is essentially rocket fuel. The bacteria naturally consume ammonia and produce hydrazine.



How do they benefit everyone?

- They have a special impact on the biosphere. They are the backbone of ecosystems of zones where light cannot go. In these zones, chemosynthetic bacteria are present. They provide the essentials for energy and carbon to other organisms there. *They benefit everyone because their symbiotic relationship have special effects on the ecosystem.

How do they interact with other microbes and larger organisms?

- Plant immune response: plants are constantly exposed to pathogens.
*Pathogens often send protein effectors to the plant cell to suppress immunity to allow growth of disease. In response to these potential attacks, plants have R proteins which monitor the pathogens to prevent them from spreading the disease. This process allows the plant to do its job completely

Career Options

- Environmental Manager: develop, implement, and maintain environmental strategies and programs.
- Stream/Wetland Restoration Scientist: provides planning, engineering, and construction environmental consulting.
- Environmental Planner: leads, plans, and reviews projects.

