



***Basic Research in Chemistry and
Biotechnology for Elimination of Halogenated
Hydrocarbon Pollutants of Aquifers and Ground
Water***

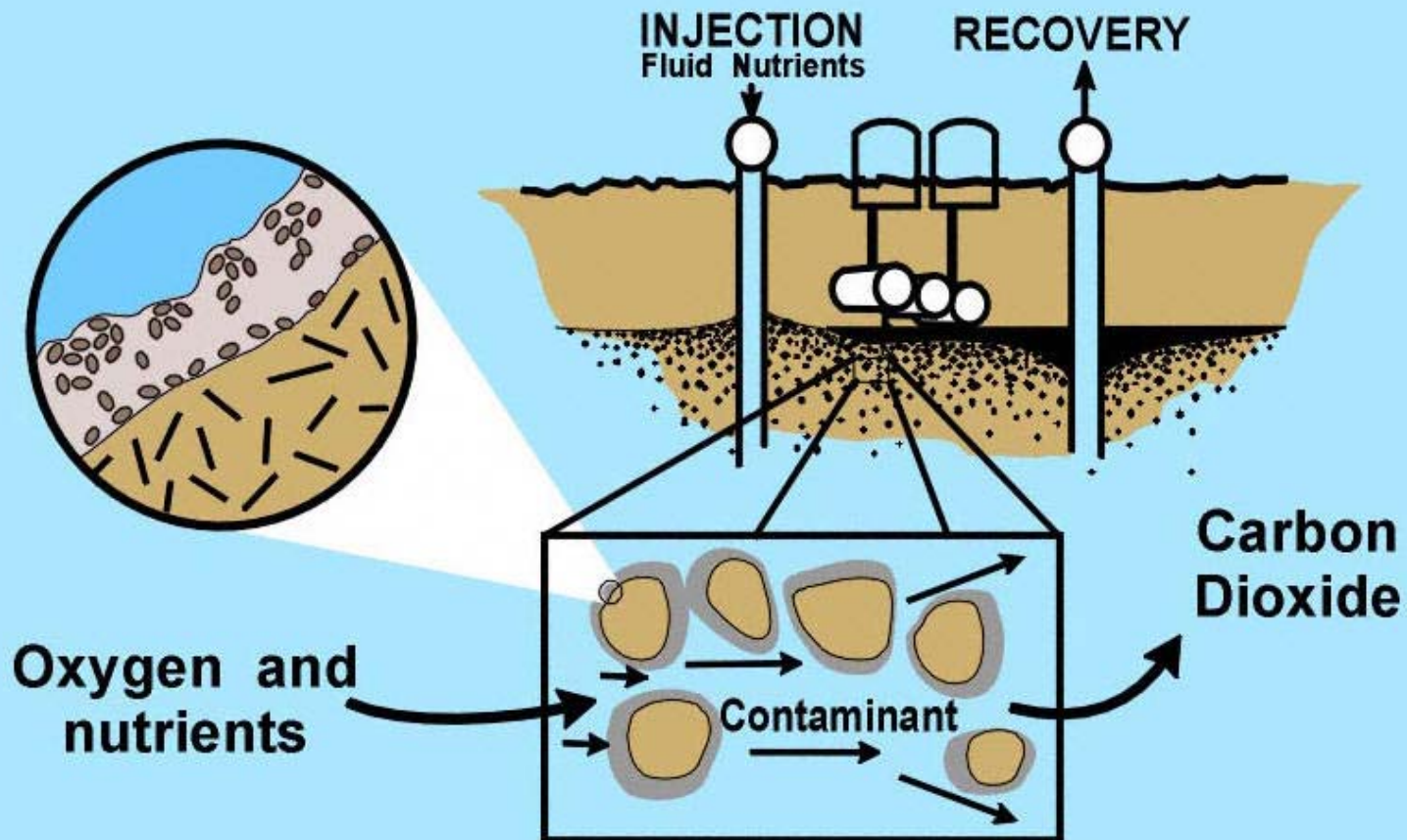
BIOTECHNOLOGY WORKING GROUP

IAB kick-off meeting

Debrecen, 10/10/2009



Bioremediation





MAJOR TYPES OF BIOREMEDIATION

Intrinsic bioremediation: occurs naturally as a work of already existing microorganisms. Application of this technique requires close monitoring of contaminant degradation.

Biostimulation: Nutrients and oxygen are added to contaminated water or soil to encourage the growth and activity of bacteria already existing in the soil or water.

Bioaugmentation: Microorganisms that can clean up a particular contaminant are added to the contaminated soil or water.



MICROBIAL DIVERSITY

The number of existing strains may be several magnitudes higher than the number of those described to date.

Microorganisms may be able to grow on substances harmful or even toxic to humans.

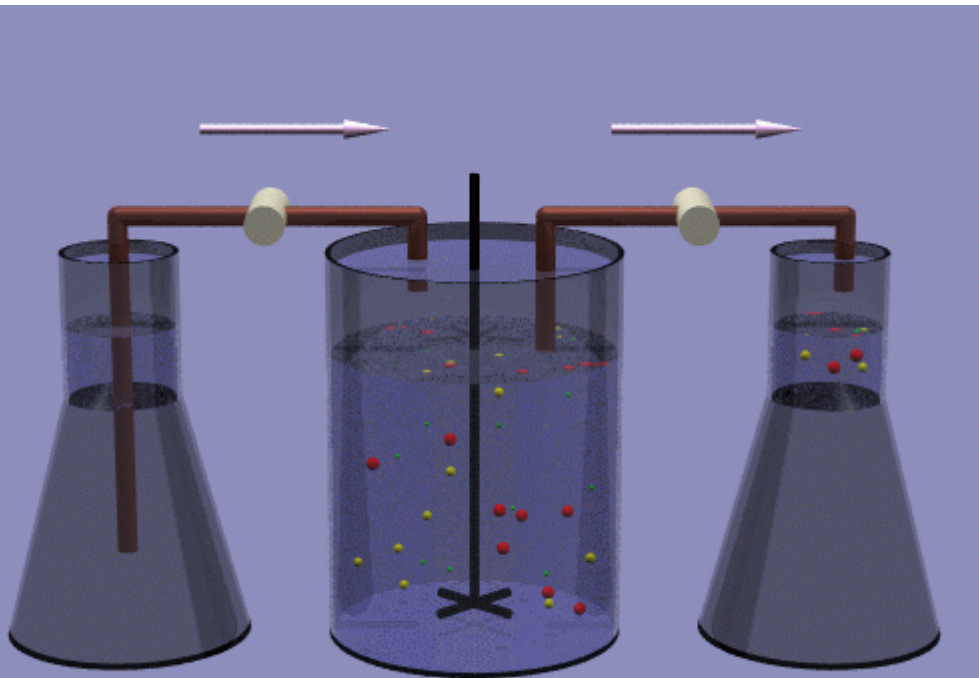
The short generation time of bacteria enables strain improvement, e.g. creating new strains with substantially different geno/phenotypes.

New traits are most likely neutral, but they may happen to be beneficial.

STRAIN IMPROVEMENT

Aim: engineering of microorganisms capable of degrading and metabolizing chlorated hydrocarbons

Tool: chemostat-type continuous cultivation of microorganisms



Steady-state chemostats exert a strong selective pressure and result in the enrichment of evolved geno/phenotypes. Under nutrient-limited conditions, selection is primarily for an improved affinity for the growth-limiting nutrient.



RESEARCH STRATEGY

- 1) To set up a **chemostat-type continuous cultivation system** to alter the concentrations of any components in the medium under steady-state conditions and defined growth rates.
- 2) Characterization of the bacterial strains exhibiting **new geno/phenotypes**.
- 3) Studies towards designing a **larger-scale bioremediation** technique employing these bacterial strains.



MAJOR RESEARCH DIRECTIONS

- 1) Purchasing bacterial strains exhibiting an ability **to metabolise chlorated hydrocarbons.**
- 2) Supplementation of the growth medium with **increasing concentrations** of chlorated hydrocarbons.
- 3) Depletion of the growth medium of readily metabolizable carbon sources.
- 4) Analysis of the **matrix effect** of the contamination site.
- 5) Experimental **bioremediation** in laboratory fermentors.
- 6) Experimental ***in situ*** bioaugmentation.



chlorated hydrocarbons