Fundamentals of Biological Interventions

- The manipulation of natural cycles lies at the heart of much environmental biotechnology and engineering solutions to the kinds of problem for which this technology is appropriate, typically centers on adapting existing organisms and their inherent abilities
- For the most part, the sorts of ‘environmental’ problems that mankind principally concerns itself about, are those which exist in the portion of the biosphere which most directly affects humanity itself.

- As a result, most of the organisms used share many of our own needs and the majority of the relevant cycles are ones which are, at least, largely familiar.
- While other aspects of biotechnology may demand techniques of molecular biology and genetic manipulation
- This is not to say that genetically manipulated organisms (GMOs) have no relevance to the field, but rather that, on the whole, they are greatly eclipsed in much of current practice by rather more ordinary organisms.

Using Biological System

- Consequently, a number of themes and similarities of approach exist, which run as common and repeated threads throughout the whole of the science.
- Thus, optimisation of the activities of particular organisms, or even whole biological communities, to bring about any desired given end, typically requires manipulation of local conditions.

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- Control of temperature, the accessibility of nutrients and the availability of oxygen are commonly the tools employed, especially when the target effectors are microbes or isolated biological derivatives.
- The typical factors affecting the use of biological systems in environmental engineering relate to the nature of the substances needing to be removed or treated and to the localised environmental conditions pertaining to the particular situation itself.

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- The intended target of the bio processing must generally be both susceptible and available to biological attack, in aqueous solution, or at least in contact with water, and within a low to medium toxicity range.
- Generally, the local environmental conditions required would ideally offer a temperature of 20–30◦C but a range of 0–50◦C will be tolerated in most cases, while an optimum pH lies in the range 6.5–7.5, but again a wider tolerance of 5.0–9.0 may be acceptable, dependent on the precise organism involved.

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- For land-based applications, especially in the remediation of contamination or as a component of integrated pollution control measures, there is an additional common constraint on the substrate.
- Typically the soil types best suited to biotechnological interventions are sands and gravels, with their characteristically low nutrient status, good drainage, permeability and aeration.

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- By contrast, biological treatments are not best suited to use in clays or peat or other soils of high organic content.
- In addition, generalized nutrient availability, oxygenation and the presence of other contaminants can all play a role in determining the suitability of biological intervention for any given application.