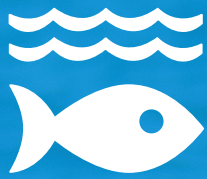


SDG 14

LIFE BELOW WATER



LIST OF ACTIVITIES

SR. NO.	ACTIVITY TITLE
1	Plastic-Free Awareness Desk Initiative
2	Ocean Conservation Awareness Desk
3	Water Purification & Marine Life Poster Competition





ACTIVITY 01: PLASTIC-FREE AWARENESS DESK INITIATIVE

Organized By:
The Department of Bioinformatics & Biosciences



An awareness desk activity was conducted to highlight the harmful impacts of plastic pollution and promote a plastic-free lifestyle. Informative materials, interactive discussions, and pledge activities encouraged participants to reduce, reuse, and recycle plastic while adopting eco-friendly alternatives. The initiative emphasized how plastic waste affects marine life, pollutes oceans, and disrupts aquatic ecosystems. It aligned with SDG 14, particularly Target 14.1, by raising awareness about reducing marine pollution from land-based activities. The activity fostered responsible behavior and encouraged participants to minimize plastic use in daily life. It contributed to protecting aquatic ecosystems and promoting sustainable practices for cleaner and healthier water bodies.





ACTIVITY 02: OCEAN CONSERVATION AWARENESS DESK

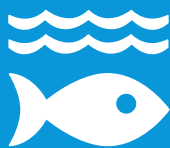
Organized By:
The Department of Bioinformatics & Biosciences



The Department of Bioinformatics and Biosciences organized a seminar under the supervision of Dr. Arshia Amin, with Mr. Muhammad Zameer as the speaker. The seminar was attended by MS and PhD students, along with faculty members. Mr. Muhammad Zameer discussed bacterial signaling, explaining how communication among disease-causing bacteria strengthens their adaptability in various habitats, including oceanic regions, deep water bodies, wastewater, and land. The event aimed to explore these communication mechanisms for better bacterial control while identifying research gaps and future opportunities. The session aligned with Sustainable Development Goal (SDG) 14: Life Below Water, as bacterial communication influences both terrestrial and aquatic ecosystems. The sub-targets of SDG 14 covered in the discussion were: 14.1 (reducing marine pollution caused by pathogenic bacteria), 14.2 (protecting marine ecosystems from bacterial contamination) and 14.5 (conserving aquatic biodiversity affected by bacterial infections).



14 LIFE BELOW WATER



ACTIVITY 03: WATER PURIFICATION & MARINE LIFE POSTER COMPETITION

Organized By:
The Department of Bioinformatics & Biosciences

Industrial-Scale Biological Mechanisms for Environmental Crew into Industrial Powerhouses

Mr. Abid Ur Rehman
Biotechnologist, Capital University of Science and Technology, Islamabad, Pakistan.

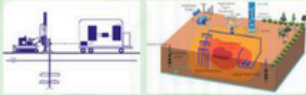
Abstract
Environmental pollution by industrial waste, heavy metals, and hydrocarbons poses a critical global threat. This project explores the industrial-scale application of biological mechanisms for environmental remediation. We review key processes, including microbial degradation, phytoremediation, and mycoremediation, as eco-friendly and cost-effective alternatives to traditional physicochemical methods. By examining existing techs like bioreactors, constructed wetlands, and future enhancements using genetic engineering, this poster highlights the "how-to" of transforming natural cleanup crews: microbes, plants, and fungi, into industrial powerhouses for a cleaner environment.

Introduction
The Problem: Widespread industrial, agricultural, and urban activities release persistent pollutants (heavy metals, pesticides, plastics, hydrocarbons) into water and soil, threatening ecosystem and human health.
The Conventional Fix: Traditional cleanup methods (e.g., chemical precipitation, excavation) are often extremely expensive, energy-intensive, and can produce toxic secondary waste.
The Biological Solution: Bioremediation leverages the metabolic potential of living organisms to degrade, sequester, or detoxify contaminants. This approach is sustainable, eco-friendly, and often significantly more cost-effective.

Materials and Methods
This section outlines the primary technologies used to apply biological mechanisms at an industrial scale.

- In-Situ (On-site) Technologies:** Treating contamination in place.
- Bioventing:** Injecting air/oxygen into soil to stimulate aerobic bacteria to degrade pollutants.
- Biosparging:** Injecting air below the water table to promote remediation of groundwater.
- Phytostabilization:** Using plants to immobilize contaminants in the soil, preventing their spread.
- Ex-Situ (Off-site) Technologies:** Excavating/pumping contaminated material for treatment.

- Bioreactors:** Controlled, large-scale engineered vessels where microbes are mixed with contaminated water or soil slurry under optimized conditions (temperature, pH, nutrients).
- Biopiles:** Excavated soil is mixed with amendments and piled to promote microbial activity.
- Bioaugmentation:** Adding specialized, pre-grown microbial cultures (like *Pseudomonas putida*) to a site to speed up degradation.
- Genetic Engineering (GEMs):** Using tools like CRISPR-Cas9 to create "super-microbes" with enhanced pathways for degrading highly persistent pollutants (e.g., plastics, certain pesticides).



Results: Mechanisms in Action
Microbial Degradation (Oil Spills): Bacteria like *Pseudomonas putida* and *Akanivoxa hokkaidensis* are "hydrocarbon specialists." They secrete powerful enzymes that break down complex hydrocarbon chains in oil into simple, harmless products like CO₂ and water.


Phytoremediation (Heavy Metals):
Phytoextraction: "Hyperaccumulator" plants like Indian Mustard (*Brassica juncea*) and Alpine Pennycress (*Thlaspi caerulescens*) actively absorb and store high concentrations of heavy metals (like lead, cadmium, zinc) from the soil into their harvestable shoots and leaves.

Mycos & Phytoremediation (Wastewater):
Fungi: White-rot fungi (e.g., *Phanerochaete chrysosporium*) produce lignin-degrading enzymes that non-specifically break down a wide range of stubborn pollutants, including pesticides and dyes.


Algae: Microalgae (e.g., *Chlorella vulgaris*) are highly effective at nutrient removal. In wastewater treatment, they rapidly consume nitrogen (N) and phosphorus (P), the main causes of eutrophication, while simultaneously producing valuable biomass.

Quantitative Success:
Constructed wetlands consistently demonstrate >90% removal efficiency for Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) from municipal wastewater.

Bioremediation of the Exxon Valdez oil spill was shown to increase degradation rates 3-5 times compared to untreated shorelines.



Conclusion
Proven Efficacy: Biological mechanisms are scientifically validated, powerful, and versatile tools for environmental cleanup.
Key Advantages: They are sustainable, have a lower carbon footprint, and are often dramatically more cost-effective (up to 60-80% cheaper) than traditional engineering methods.
Current Challenges: Scaling up can be limited by slow biological growth rates, precise environmental condition requirements (pH, temp), and public perception of Genetically Engineered Microorganisms (GEMs).
Future Prospects: The future lies in Synthetic Biology to design custom microbes for specific pollutants, Nanobiotechnology (using nanoparticles to enhance microbial activity), and integrating remediation into a Circular Bioeconomy (e.g., harvesting metal-rich plants or converting algae to biofuel).



A poster competition was conducted to raise awareness about clean water, sustainable practices, and the protection of marine ecosystems. Students presented creative and thought-provoking posters highlighting causes and consequences of water pollution, along with innovative solutions for purification and conservation. The activity emphasized the connection between water quality and the survival of marine life, promoting environmental responsibility. It aligned with SDG 14, particularly Target 14.1, by encouraging awareness on reducing water pollution and protecting aquatic ecosystems. The initiative fostered creativity, critical thinking, and environmental consciousness among students. It contributed to promoting sustainable practices and safeguarding marine biodiversity.

