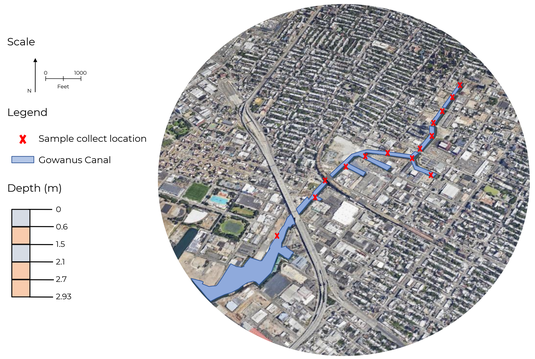
# From Contamination to Remediation: Hydrogel for Heavy Metal Removal

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The Gowanus Canal, one of the most severely polluted waterways in the United States, was listed as a Federal Superfund site by the Environmental Protection Agency (EPA) in 2010 due to heavy metal and other toxic substances. Our project focuses on developing protein-based hydrogels for bioremediation of contaminated water. These hydrogels leverage proteins' affinity for heavy metals, enabling efficient capture and removal from the canal. By deploying this innovative technology, we aim to enhance water quality, restore the canal's natural ecosystem, and contribute to the well-being of surrounding communities.

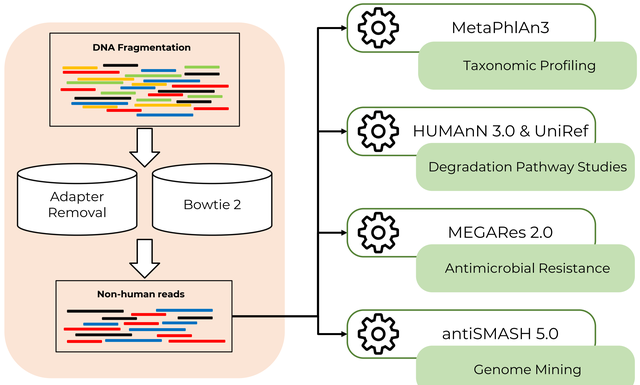
## Gowanus Canal Brooklyn, NY




## Shotgun Metagenome Sequencing



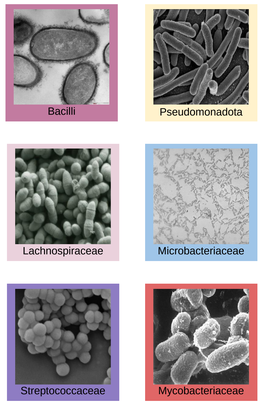

## Preprocessing Data



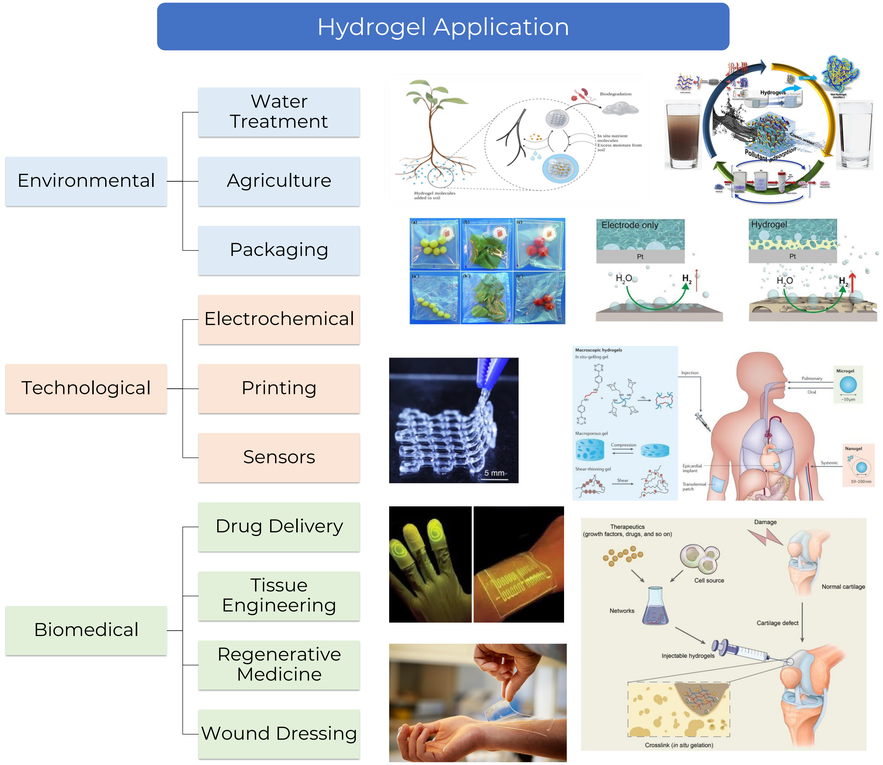

## Bioinformatic Tools

Unipro UGENE · AlphaFold · NCBI BLAST · UniProt · CLUSTAL · Rosetta Commons · IonCom Ion Ligand Binding Site Prediction · SnapGene

## Metal-related Bacterial Taxonomy

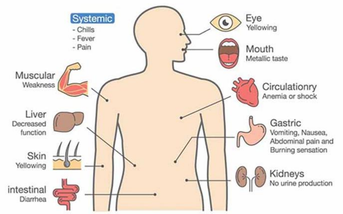



## Hydrogel Application

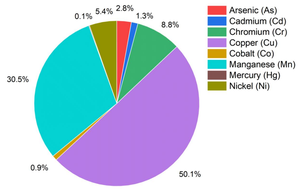



Journal of Polymers and the Environment 31(9):1-18
Chemosphere 331 (2023) 138743
Advances in Sustainable Polymers. Materials Horizons: From Nature to Nanomaterials
Journal of Drug Delivery Science and Technology 49 (2019) 642–659
Front. Bioeng. Biotechnol. 10:954501

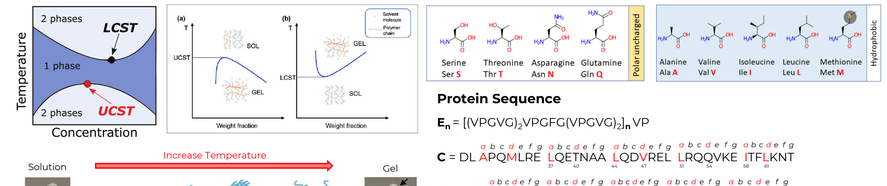
## Heavy Metal Concentration and Effects




| Heavy Metal | Detected Values (ppm) |
|---|---|
| As | 3.4 - 44.7 |
| Cd | 1.5 – 20.2 |
| Cr | 22.7 - 139 |
| Cu | 85.8 – 790 |
| Co | 6.5 – 14.8 |
| Fe | 12400 – 87000 |
| Pb | 146 – 4220 |
| Mn | 89.1 – 480 |
| Hg | 0.59 – 2.3 |
| Ni | 18.1 – 84.5 |




## Protein Design

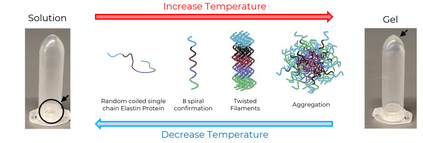


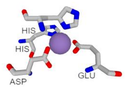

**Protein Sequence**

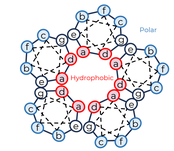
$E_n$ = $[(VPGVG)_2VPGFG(VPGVG)_2]_n$VP

**C** = DL APQMLRE LQETNAA LQDVREL LRQQVKE ITFLKNT

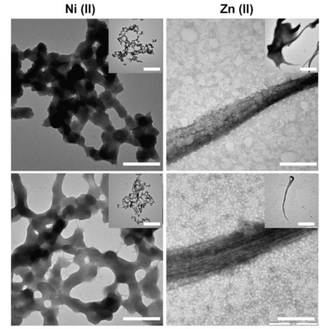
**Q** = VKE QTFIKNT IEQMAEE IKEINKA IHDIRHQ LENMSKQ

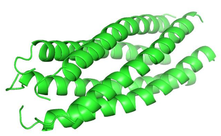


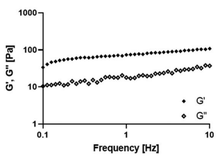



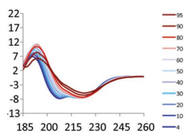

**Transmission Electron Microscopy (TEM) Images**








Biomacromolecules 2024, 25, 258−271
Biomacromolecules 2022, 23, 4851−4859
Biomacromolecules 2011, 12, 4240−4246

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