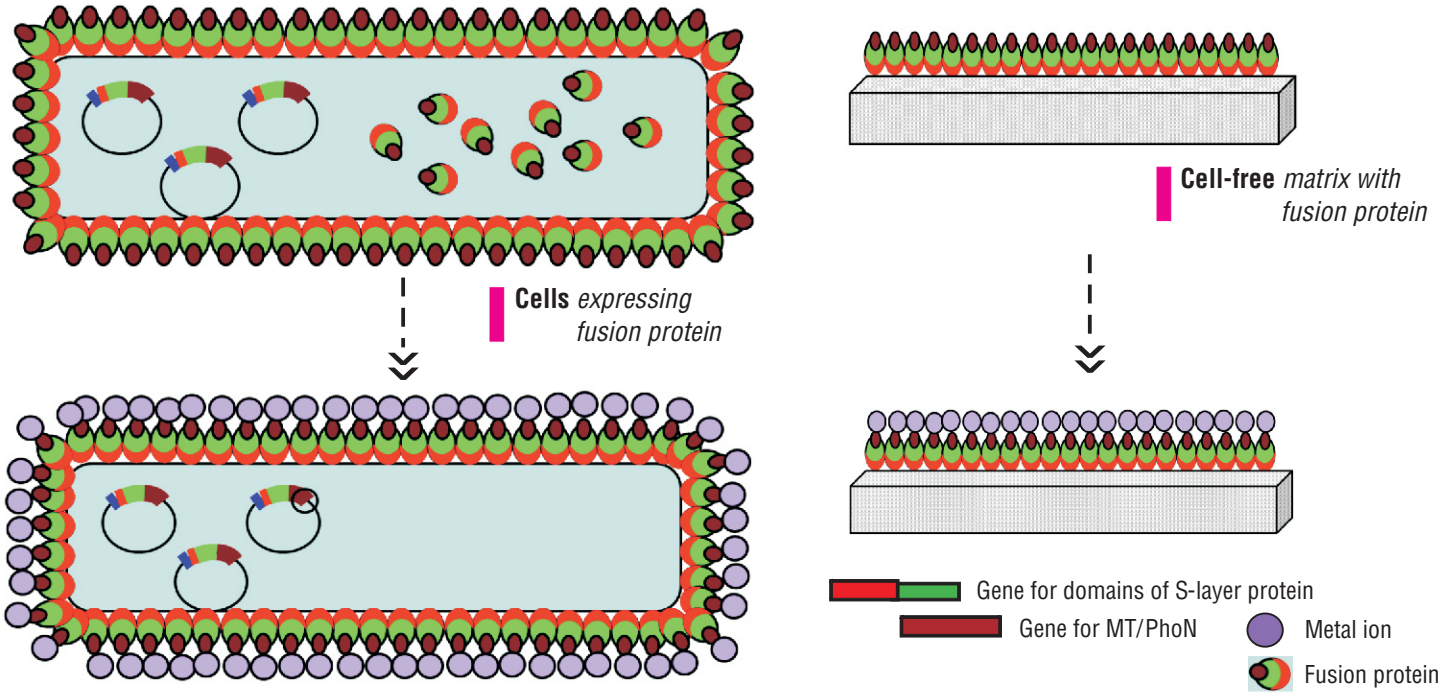

Fusion proteins for enhanced metal bioremediation

The genetically modified cells of Deinococcus radiodurans genetically modified to display SmtA on cell surface could remove three-fold more cadmium from solution compared to cells expressing SmtA inside the cell

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Heavy metal pollution is a difficult problem, since unlike other pollutants, heavy metals cannot be destroyed, but only removed, concentrated or converted into non-toxic forms. Living forms possess several metabolic processes which either sequester heavy metals or convert them to non-toxic forms. Bioscience Group has been investigating microbes for metal remediation.

In a recent article, (C.S. Misra *et al*., 2021,'Metal removal by metallothionien (MT) and an acid phosphatase PhoN, surface-displayed on the cells of the extremophile, *Deinococcus radiodurans*', Journal of Hazardous Materials, 419:126477) we reported the enhanced loading of Cd onto bacterial cell surface using surface display technique. This study reported the generation of a fusion protein consisting of Hpi and SmtA. Here, SmtA is a metallothionine, that is specialized to mop up metal ions such as cadmium and zinc from solutions and Hpi is a Surface Layer Protein (S-layer protein) that can form a densely-packed array on the cell surface (above image). Cells of Deinococcus radiodurans genetically modified to display SmtA on cell surface could remove three-fold more cadmium from solution compared to cells expressing SmtA inside the cell.

Additionally, we reported the construction of another fusion protein embedded into peptidoglycan, an inert cell wall matrix. This new material, called SPhoNP (above image) could precipitate uranium from 1 mM solution for up to five cycles, leading to a final U loading of 160mg U/g dry mass. The work demonstrates the utility of whole cell-based material and cell-free preparations for cadmium sequestration and uranium removal using recombinant DNA technology and surface-display approach*.