

Risks and benefits with 'synthetic cells' for environmental applications

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The past two years have seen a flurry of activity

nature microbiology

Review article

<https://doi.org/10.1038/s41564-024-01918-0>

Design and regulation of engineered bacteria for environmental release

Cell

Leading Edge

Review

Scientists' call to health, and the S

nature reviews microbiology

<https://doi.org/10.1038/s41579-023-01007-9>

Review article

 Check for updates

Synthetic microbiology in sustainability applications

Ethan M. Jones^{1,2,5}, John P. Marken^{3,4,5} & Pamela A. Silver^{1,2} 

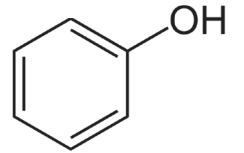
Bioremediation case study in Estonia, 1988-1989



Estonian oil shale industry



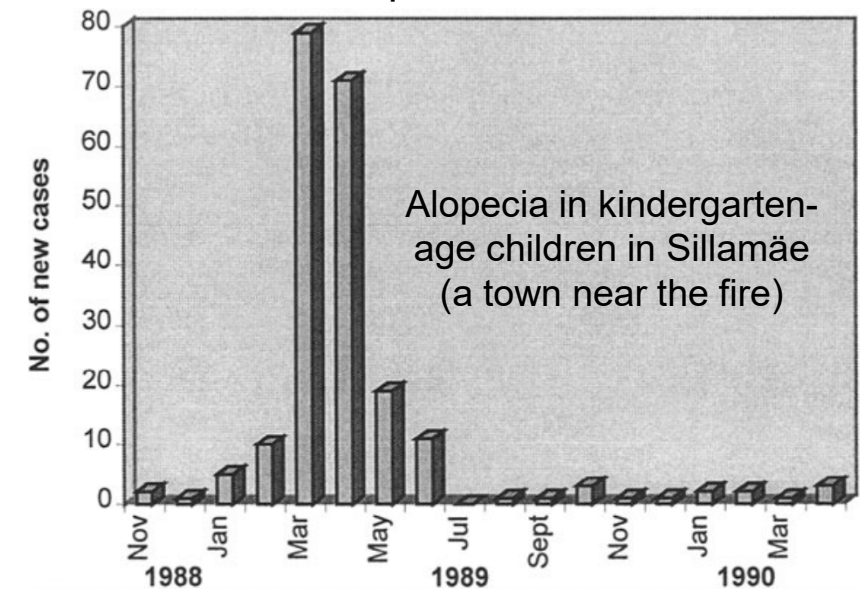
Up to 30% phenol



Estonia Oil Shale Mine fire, Nov. 1988

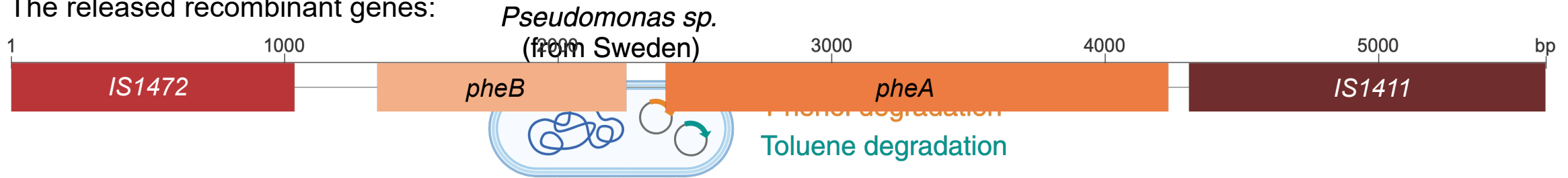


Consequences of the fire

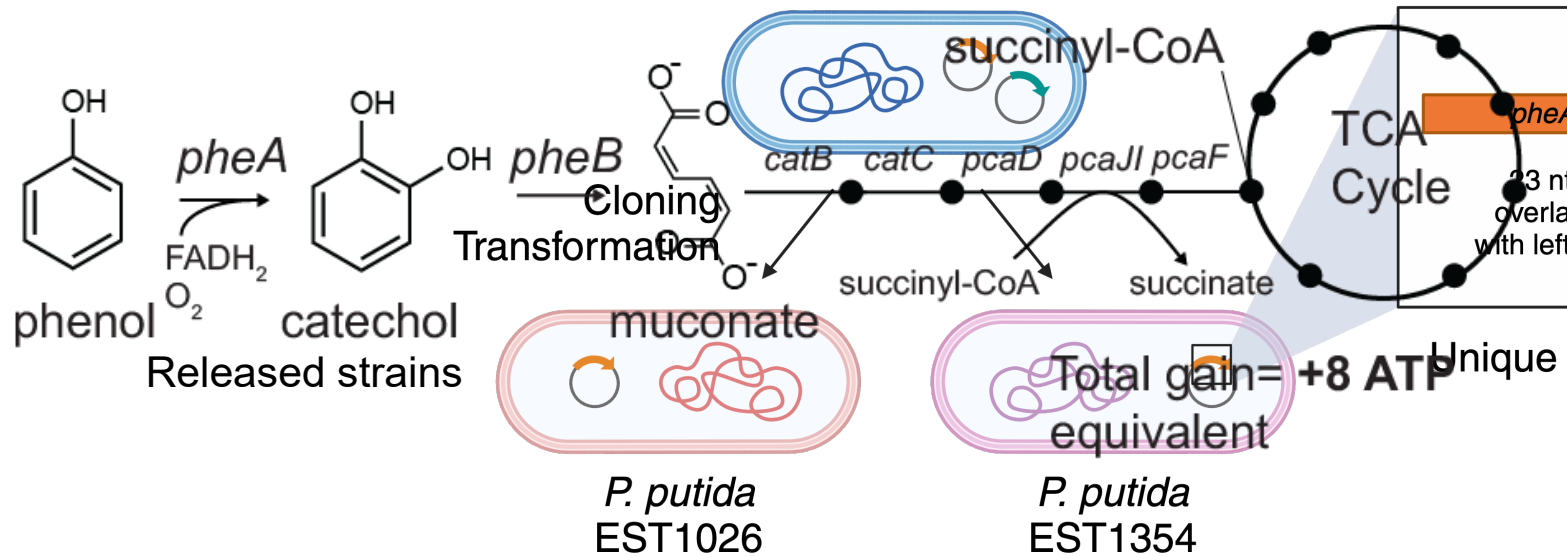


Genetic engineering and release of phenol-degrading bacteria

The released recombinant genes:

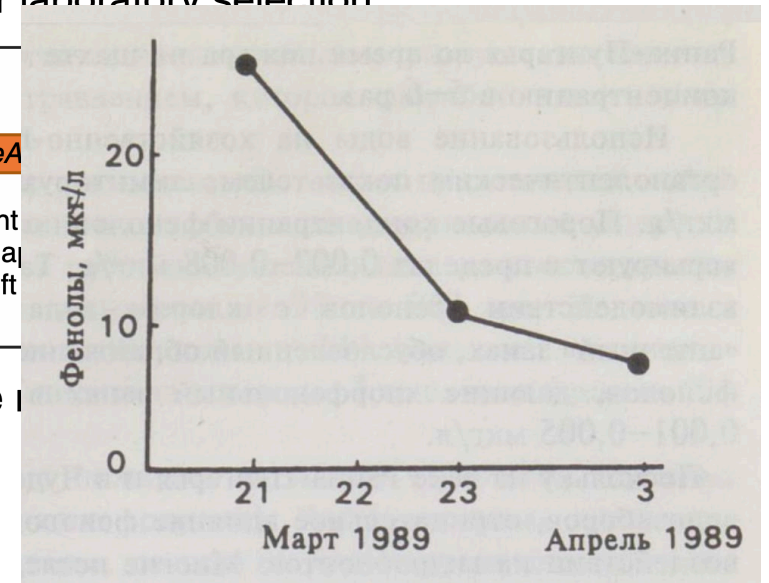


Directed evolution

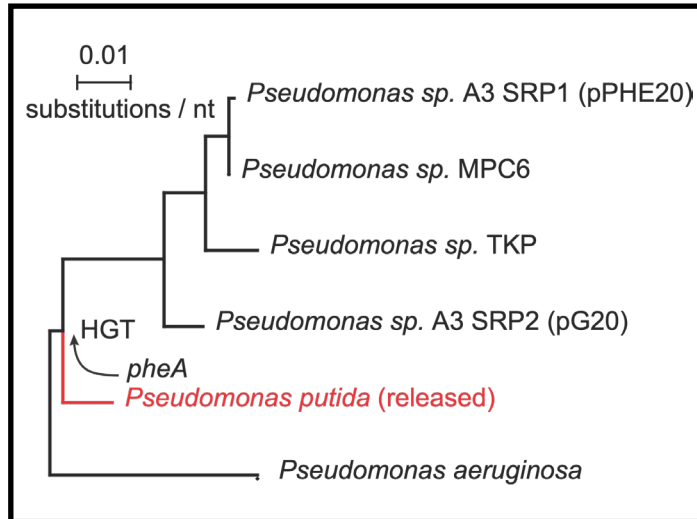


Phenol in the mine waters, post-treatment with bacteria

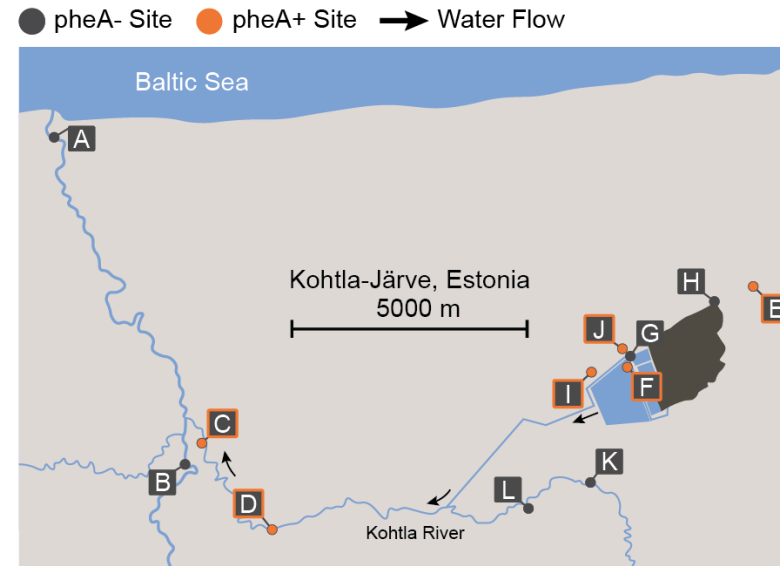
After laboratory selection



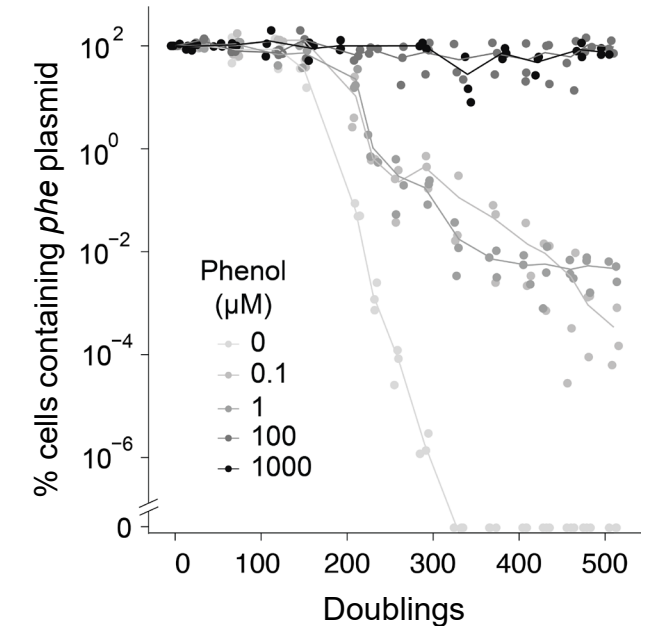
Released recombinant genes are maintained in areas with phenol



Lab-originated genetic constructs were found, but not their original host. Genes were likely horizontally transferred to and maintained in native Pseudomonads



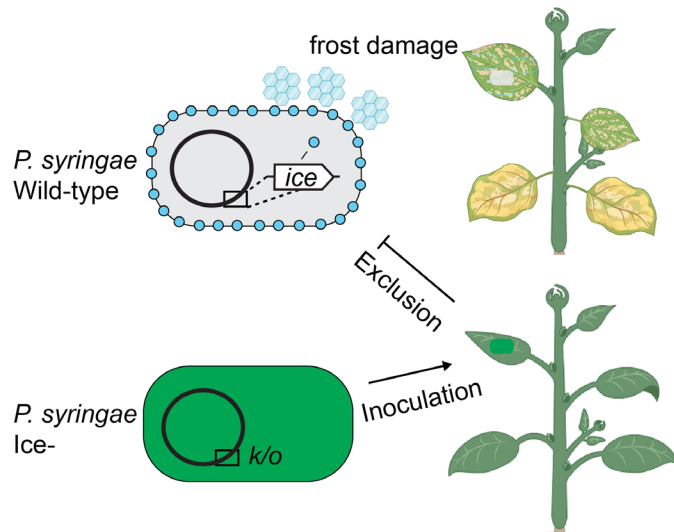
Released genes are detected only in areas with continuous phenol pollution for the past thirty-five years.



The originally released plasmid is lost without selective pressure.

Benefits and risks, largely unknown and hyped, are locked in a catch-22

Frost: \$1.6 billion/year in damage



First experiment release:
Ice- Pseudomonas syringae



Published field trials with engineering bacteria

