Zn2+ detection and bioremediation at the Lehigh Gap Nature Center Superfund site (c.a.t.b.d.)

\*\*\*

Palmerton, PA zinc smelting operation from 1898 to 1980

 Estimated emissions = 1400–3600 lbs of SO2 per hour —> massive nearby deforestation

<http://lgnc.org/conservation>

47 tons of Cd per year

 95 tons of Pb per year

 3575 tons of Zn per year

Estimated accumulations = 1300 ppm Cd

 6474 ppm Pb

 32,085 ppm Zn

[data from http://www.palmertoncitizens.org/History%20of%20Palmerton.htm]

Beginning in 2003, phytoremediation efforts have taken place with good results.

<http://www.dcnr.state.pa.us/wrcp/wildnotes/spring10/lehigh3.html>

\*\*\*

Construct a biosensor for Zn/Cd/Pb using BioBrick parts

 Cf. As sensor ([Groningen](http://2009.igem.org/Team%3AGroningen) , [Edinburgh](http://parts.mit.edu/wiki/index.php/University_of_Edinburgh_2006))

 Cf. [E. chromi project](http://2009.igem.org/Team%3ACambridge) (for detection sensitivity/colors)

Create a BioBrick with Zn-sensitive promoter:

 [zntR (E. coli) = Zn-responsive activator](http://www3.interscience.wiley.com/journal/119078760/abstract)

 *zntA* (*E. coli*) = Zn-effluxing ATPase

 *zur* (*E. coli*) = Zn-responsive repressor of *znu* operon

Fuse appropriate promoter to RBS + detector (eg. RFP)

Questions/tweaks: speed of response

 Limit of detection (2-stage amplification?)

Soil sample + water, remove soil and test supernatant —> bioavailable Zn + Cd + Pb

 Remove Pb chemically, retest —> bioavailable Zn + Cd

 Remove Cd chemically, retest —> bioavailable Zn

\*\*\*

Compare levels with those derived from AA —> bioavailable Zn vs. total Zn (et al.)

Can Zn (et al.) be sequestered within cells?

 [Cf. sequestration into vacuoles in plants](http://www3.interscience.wiley.com/cgi-bin/fulltext/121541019/HTMLSTART)

 [glomalin Zn-binding proteins secreted from fungi?](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V78-4RD44B6-2&_user=2665120&_coverDate=03%2F15%2F2008&_rdoc=15&_fmt=high&_orig=browse&_srch=doc-info(%23toc%235836%232008%23996079998%23679032%23FLA%23display%23Volume)&_cdi=5836&_sort=d&_docanchor=&_ct=19&_acct=C000058476&_version=1&_urlVersion=0&_userid=2665120&md5=033a65fe315aea9c5a900b9902ca18d1)

 Can efflux proteins be inverted in membrane?

 Is active transport inward necessary? Overexpress normal influx proteins (?)

Does sequestration involve complexing with sulfur (e.g. Cys residues)? If so, does death of carrier cell result in (biologically inert) Zn sulfides?