Expression Of Mercuric Ion Reductase In Eastern Cottonwood Confers Mercuric Ion Reduction And Resistance

D.S. Che[1], R.B. Meagher[2], A. Lima[1], A.C.P. Heaton[2] and S.A. Merkle[1]

[1]*Daniel B. Warnell School of Forest Resources, and*
[2]*Genetics Department, University of Georgia, Athens, GA 30602 USA*

ampilima@hotmail.com

Phytoremediation, the use of plants to clean up polluted soil, water or air, may offer an effective means of treating sites contaminated with mercury, one of the most hazardous heavy metals. Previous studies demonstrated that transgenic model plants expressing a modified mercuric ion reductase gene from bacteria could reduce the highly toxic, ionic form of mercury [Hg(II)] to less toxic elemental mercury [Hg(0)]. Fast-growing riparian trees, such as eastern cottonwood (*Populus deltoides*) engineered with this gene should make powerful tools for remediation of mercury contaminated soils. Following *Agrobacterium*-mediated transformation, we regenerated transgenic eastern cottonwood trees expressing modified *merA9* and *merA18* genes. Leaf sections from transgenic plantlets produced adventitious shoots in the presence of 50 mM mercuric chloride ($HgCl_2$), which inhibited shoot induction from wild-type control leaf sections. Transgenic shoots cultured in medium containing 25 mM $HgCl_2$ elongated normally and rooted, while wild-type shoots were killed. When transgenic cottonwood plantlets were exposed to Hg(II), they evolved 2-4 times amounts of Hg(0) relative to wild-type plantlets. In a preliminary test, *merA* cottonwood plants potted in mercuric ion-contaminated soil showed little inhibition of growth, while nontransformed controls died within 48 hours.