



Metal hyperaccumulators: extreme trace element biology and its applications

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Metal hyperaccumulating plants represent an extreme example of how organisms interact with trace elements in the environment. Hyperaccumulators mediate a mobility of trace elements from the soil to above-ground organs that results in trace element accumulation several hundredfold higher than normally occurs in plants. Thus, this trait offers unique opportunities to unravel molecular mechanisms underlying soil-to-plant fluxes of trace elements. Furthermore, understanding hyperaccumulation helps uncover key nodes of the metal homeostasis network whose alterations can drastically modify metal accumulation and tolerance in plants. Such knowledge has far-reaching perspectives. First, it can directly be used to develop biotechnological tools for (i) fighting trace element deficiencies in humans, animals and crop plants (biofortification) and (ii) phytoremediation of trace element-polluted soils. Second, it can guide various applied approaches towards these goals by providing information on which processes and genes to target when screening natural variation in plant trace element accumulation.

The metal hyperaccumulation field is currently achieving exciting progress by rapidly moving towards the molecular elucidation of major hyperaccumulation genes, the identification of key evolutionary events, and the comprehensive exploration of natural diversity within hyperaccumulating species. These advances are highly relevant for a wide range of researchers working on different aspects of trace element fluxes in the environment.