Arsenic and new rice

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Amid recent reports of dangerous levels of arsenic being found in some baby rice products, scientists have found a protein in plants that could help to reduce the toxic content of crops grown in environments with high levels of this poisonous metal. Publishing in the open access journal *BMC Biology*, a team of Scandinavian researchers has revealed a set of plant proteins that channel arsenic in and out of cells.

Arsenic is acutely toxic and a highly potent carcinogen, but is widespread in the earth's crust and easily taken up and accumulated in crops. Contaminated water is the main source of arsenic poisoning, followed by ingestion of arsenic-rich food, especially rice that has been irrigated with arsenic-contaminated water. According to the WHO, arsenic has been found approaching or above guideline limits in drinking water in Argentina, Australia, Bangladesh, Chile, China, Hungary, India, Mexico, Peru, Thailand, and the US.

Until now, scientists have been unable to identify which proteins are responsible for letting arsenite, the form of arsenic that damages cellular proteins, into plant cells. Now Gerd Bienert and his colleagues from the University of Copehangen, Denmark and the University of Gothenburg, Sweden, are the first to show that a family of transporters, called nodulin26-like intrinsic protein (NIPs), can move arsenite across a plant cell membrane. NIPs are related to aquaglyceroporins found in microbes and mammalian cells and which have already been shown to function as arsenite channels in these other organisms.

Bienert's team put the plant genes coding for different NIP transporters

into yeast cells in order to test the cells for arsenic sensitivity. The researchers found that the growth of yeast containing certain plant NIPs was suppressed when arsenite, one of the predominant forms of arsenic found in soil, was added to the mix. They showed that the arsenite was channelled by NIPs and accumulated inside the yeast cells. Further investigations showed that only a subgroup of NIPs had arsenite transport capabilities, and have now been identified as metalloid channels in plants.

More surprisingly, the researchers also found that when they added arsenate some yeast, cells actually grew better and arsenite was released out of the cells. "It appears that some NIPs don't just transport arsenite in one direction", says Bienert. "They are bidirectional and, given the right conditions, can clear cells of toxic arsenite as well as accumulate it. This striking exit of the accumulated arsenite in cells could have an important role to play in the detoxification of plants, especially coupled with possibility of engineering a transporter that discriminates against arsenite uptake in the first place."

Source: BioMed Central