

# Research uncovers basis for cadmium toxicity

March 4 2015, by Robyn Mills

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University of Adelaide research has uncovered how the metal cadmium, which is accumulating in the food chain, causes toxicity in living cells.

Published in the journal *Nature Communications*, this research has shown how cadmium disrupts the transport of the essential metals manganese and zinc into and out of cells.

"Cadmium is a very important industrial [metal](#), but exposure to it results in accumulation in the [food chain](#), leading to toxicity in animals and humans," says project leader Dr Christopher McDevitt, Senior Research Fellow and Deputy Director of the University's Research Centre for Infectious Diseases.

"Exposure to cadmium can occur due to poor disposal of industrial or electronics waste, and also through cigarette smoke and ingestion of contaminated food. While the toxicity of cadmium has been known for a long time, how it causes toxicity and damages cells hasn't been understood."

"We've shown, in a model bacterial system, that the chemistry of cadmium allows it to bypass the mechanisms that prevent other metals, such as iron and zinc, from freely entering cells.

"Once inside the cell, cadmium inserts itself into the cell's metal sensing machinery causing it to malfunction and pump out the wrong metal ions while still bringing in more cadmium. This ultimately leads to death of

the cell.

"This understanding of how cadmium causes toxicity, at a molecular level, is crucial for developing new strategies for preventing cadmium poisoning."

Dr McDevitt and the team of researchers including PhD student Stephanie Begg, who conducted the research, are investigating how the disease-causing bacteria *Streptococcus pneumoniae* is able to scavenge essential metals during infection, and how this might be blocked to prevent disease.

Cadmium is an important metal for a range of electronics industries and is used widely in nickel-cadmium batteries. Cadmium from [industrial waste](#) can leach back into soil and water and isn't degraded. Global cadmium production has risen by more than one thousand-fold since the beginning of the 20th century to approximately 20,000 tons per year. It is estimated that humans ingest up to 30 micrograms every day.

"Cadmium isn't used in biological systems (with one rare exception) which means that [cells](#) haven't evolved ways to deal with this metal when they encounter it," says Dr McDevitt. "Our findings here open the way for developing new therapies for preventing [cadmium](#) toxicity."

Provided by University of Adelaide

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