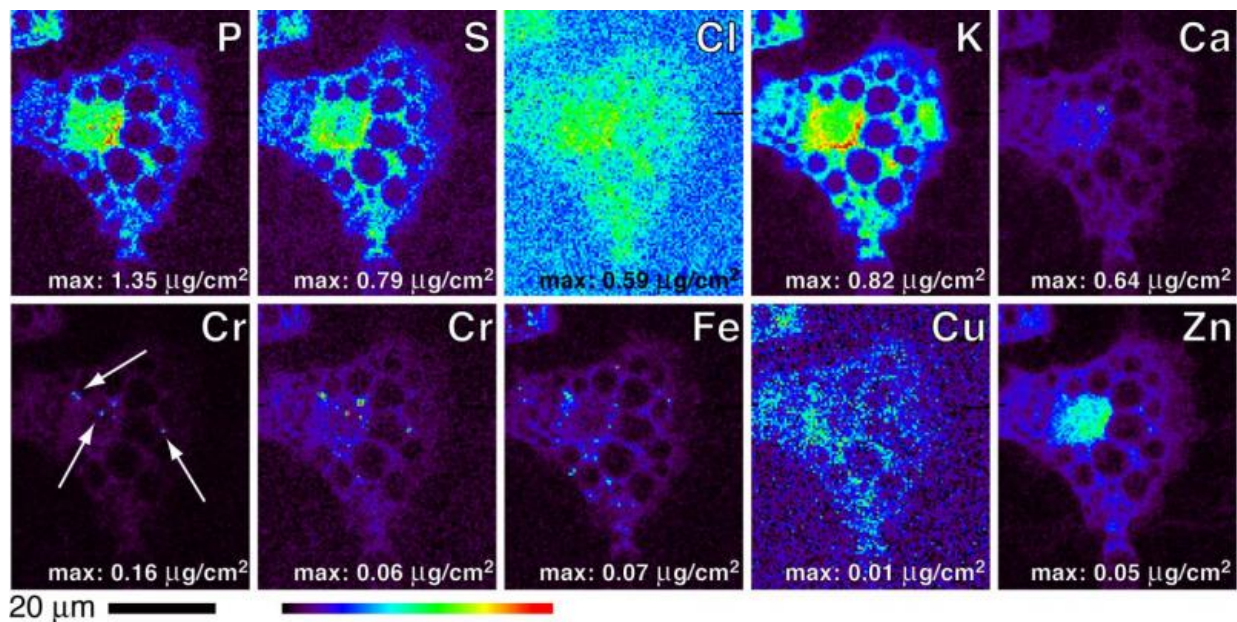


Research raises concerns over long-term use of chromium diet pills

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The synchrotron's high energy x-ray beam allowed scientists to identify chromium spots throughout the cell. By using a second high energy beam focused at these spots, the scientists were able to tell that the cell had converted into the carcinogenic form of chromium. The spots are identified by the arrows in this image. Credit: University of Sydney

Concerns have been raised over the long-term use of nutritional supplements containing chromium, after an Australian research team found the supplement is partially converted into a carcinogenic form

when it enters cells.

Chromium is a trace mineral found primarily in two forms. Trivalent [chromium\(III\)](#) picolinate and a range of other chromium(III) forms are sold as a nutritional supplements, while [hexavalent chromium\(VI\)](#) is its 'carcinogenic cousin'.

The latter gained notoriety from the book and 2000 movie, Erin Brockovich, which linked an elevated cluster of illnesses, including cancer, to hexavalent chromium in the drinking water of the Californian town of Hinkley.

The University of Sydney and UNSW researchers' concerns are based on a study published in the prestigious chemistry journal, *Angewandte Chemie*.

Controversy remains over whether the dietary form of chromium is essential for humans, with an increasing body of evidence indicating it is not safe for humans.

Supplements containing chromium are consumed for the purported treatment of metabolic disorders, such as insulin resistance and type 2 diabetes, but chromium's mechanism of action in the body is not well understood.

Supplements containing chromium are also commonly used for weight loss and body building with some containing up to 500 micrograms per tablet.

The US National Academy of Sciences has estimated up to 200 micrograms of chromium is a safe and adequate daily dietary intake for adults. Australia's current National Health and Medical Research Council Nutrient Reference Values, which are currently under review,

recommend 25-35 micrograms of chromium daily as an 'adequate intake' for adults.

In the latest study, the Australian research team treated animal fat cells with chromium(III) in the laboratory. It then created a map of every chemical element contained within the cell using an intense X-ray beam at a facility known as a synchrotron.

The team, led by Professor Peter Lay from the University of Sydney's School of Chemistry and Dr Lindsay Wu, now with UNSW's School of Medical Sciences, travelled near to Chicago to Argonne National Laboratory to perform the experiments in collaboration with colleagues at Argonne's, the Advanced Photon Source, a US Department of Energy Office of Science User Facility that generates ultra-bright, high-energy X-rays.

"The high energy X-ray beam from the synchrotron acted as a fluorescent microscope, which allowed us to not only see the chromium spots throughout the cell but also to determine whether the spots were chromium(III) or a combination of chromium(III) chromium(V) and chromium(VI)," said Dr Wu, who conducted the study while based at the University of Sydney.

"The health hazards associated with exposure to chromium are dependent on its oxidation state.

"We were able to show that oxidation of chromium inside the cell does occur, meaning it loses electrons and transforms into a carcinogenic form."

Additional experiments have since been conducted at Australia's National Beamline Facility and the Photon Factory in Tsukuba Japan, (operated by the Australian Synchrotron) that has helped clarify the

carcinogenic nature of chromium(V) and chromium(VI) formed in cells.

Professor Lay said with the latency period for chromium(VI)-related cancers often greater than 20 years, the finding raised concerns about the possible cancer-causing qualities of chromium compounds and the risks of taking chromium [nutritional supplements](#) long term or in high doses.

"With questionable evidence over the effectiveness of chromium as a dietary supplement, these findings should make people think twice about taking supplements containing large doses of chromium," Professor Lay said.

"However additional research is needed to ascertain whether chromium supplements significantly alter cancer risk."

The researchers said the findings are very unlikely to apply to trace amounts of chromium(III) found in food.

More information: *Angewandte Chemie*,
[onlinelibrary.wiley.com/doi/10 ... e.201509065/abstract](https://onlinelibrary.wiley.com/doi/10.1002/anie.201509065)

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