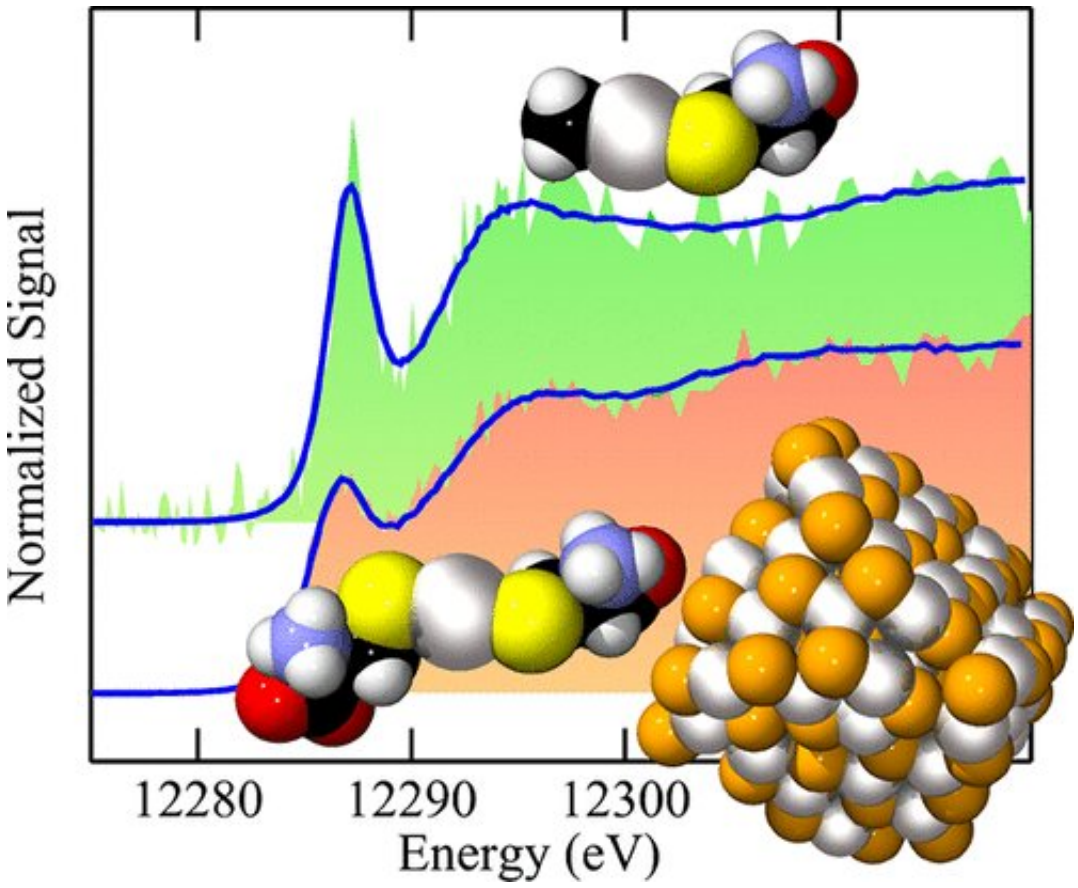
Synchrotron-based study finds a high-fish diet may not be bad for you

May 16 2022



Graphical abstract. Credit: *ACS Chemical Neuroscience* (2022). DOI: 10.1021/acschemneuro.2c00166

A synchrotron-based study led by University of Saskatchewan (USask) researchers shows that the chemical form of mercury found in the brains

of people who ate a lot of fish over a lifetime is completely different from the mercury form found in the brains of people who were poisoned.

"There is concern about mercury in the human diet because the type of mercury in fish, methylmercury, when given in large quantities causes severe health problems associated with the brain," said Dr. Graham George (D.Phil.), professor and Canada Research Chair in X-ray Absorption Spectroscopy in USask's College of Arts and Science.

"However, a large exposure to this mercury species resulting in poisoning is hugely different than low level exposure from a diet of fish containing naturally low levels of mercury," said George, a corresponding author of a paper on the findings featured on the cover of *ACS Chemical Neuroscience*.

"Studies that use acute mercury exposure as a proxy for the health impacts of consuming fish containing naturally low levels of mercury are simply misleading," he said.

Mercury and mercury compounds are natural to the environment, and all marine fish contain some level of methylmercury and have for centuries. Recent human activities that produce mercury pollution such as burning coal are increasing, releasing more mercury which can travel vast distances in the atmosphere. Consequently, environmental mercury levels are growing.

Thus, George said, as many populations worldwide rely on fish as a primary or sole source of protein, clarity on the consequences of ingesting low levels of mercury from fish is an important issue for global food security.

Researchers on the team, who employed synchrotron light techniques to

analyze mercury compounds in brain tissue, include recent USask graduate Dr. Ashley James (Ph.D.), co-corresponding USask author Dr. Ingrid Pickering (Ph.D.) and Canadian Light Source (CLS) senior scientist Dr. Gosia Korbas, along with scientists from Stanford University and the University of Rochester in New York.

They used the Stanford Synchrotron Radiation Lightsource in California and the Advanced Photon Source at the Argonne National Lab in Illinois to compare the form of mercury in brain samples from two individuals from the Republic of Seychelles who had consumed fish regularly over their lifetime, and samples from two individuals who died after accidental mercury poisoning.

One was an eminent researcher who died 10 months after direct skin contact with dimethyl mercury, and the other a child who was poisoned at the age of eight and survived in a debilitated state for 21 years after eating pork from an animal that was fed seed grain dusted with an organic mercury pesticide.

"The form of mercury in the brains of the two fish-consuming individuals is essentially unchanged from the form found in fish," said George. "There were no neuropathological consequences apparent in the Seychellois and neither had known neurological deficits that could be linked to mercury exposure."

But there were striking differences found in the brains of subjects poisoned with organic mercury, which contained mixtures of mercury compounds, including significantly elevated levels of mercury selenide compared with low-level exposures. Selenium levels in the high-fish consumers were comparable to levels in the brains of a control group with no known mercury exposure.

Selenium has a complex relationship with mercury, said George.

Depending on the species of mercury, and whether selenium enters the body before or after exposure, it can cancel or increase the toxicity of mercury.

"There have been some papers that suggest that it is safe to eat fish with high levels of mercury if the selenium content exceeds that of mercury, but it does not appear to be nearly that simple," said George. "I would advise against eating anything that contains high levels of mercury."

More information: Ashley K. James et al, Molecular Fates of Organometallic Mercury in Human Brain, *ACS Chemical Neuroscience* (2022). DOI: 10.1021/acschemneuro.2c00166

Provided by University of Saskatchewan