How does an enzyme detoxify the cells of living beings?

April 29 2015

Scientists use neutrons to shed light on the reduction of H2O2 to water by CcP, concluding that the process which is focus of a long-standing and highly contentious question need to be reassessed.

Cytochrome c peroxidase (CcP) is an enzyme thought to detoxify the cells of numerous living beings by reducing hydrogen peroxide (H2O2) to water. This process results in a semi-stable state of CcP historically called compound I. Just like in the haemoglobin that carries oxygen in our blood system, the reduction of H2O2 occurs because CcP has a ferrous centre that bonds with oxygen. However scientists do not seem to agree on the nature of the bond between the CcP ferrous centre and the oxygen, which has been cause of dispute for the past 30 years.

One of the main questions to unveil is whether the ferrous centre of CcP is bonded to oxygen through a hydrogen atom. Given that neutron scattering is a particularly suitable technique to determine the position of hydrogen atoms, to shed new light on the issue a group of scientists travelled to the Institute Laue-Langevin in France and the Heinz Maier-Leibnitz Zentrum (MLZ) in Germany to investigate the CcP enzyme crystals. To guarantee that during the analysis the enzyme was in the compound I state the experiments were conducted at temperatures as low as -173°C, at the MLZ. The latter experiments, thanks to which they determined the Compound I state, were supported through the NMI3 Access Programme. The results were published in the journal *Science*.

Contrarily to what was previously thought the results show that oxygen

does not bond to hydrogen but only to the CcP ferrous centre. Another surprising finding was that the CcP centre has a hydrogen atom more than assumed in earlier experiments. This means that the whole process of reduction of H2O2 to water by CcP needs to be reassessed.

More information: "Neutron cryo-crystallography captures the protonation state of ferryl heme in a peroxidase." *Science* 11 July 2014: DOI: 10.1126/science.1254398

Provided by CORDIS