Novel reaction mechanism to remove reactive oxygen species

The first hypervalent compound from natural sources

Aerobic organisms have evolved mechanisms to protect themselves from oxidative stress, which is caused by reactive oxygen species. Peroxiredoxin (Prx) converts hydrogen peroxide and alkyl peroxide to water and the corresponding alcohol, respectively, by the action of redox active cysteine side chain. It has been widely accepted that the oxidation of a cysteine side chain is initiated by the formation of cysteine sulfenic acid. Here, I demonstrate a new mechanism of thiol oxidation through a hypervalent sulfur intermediate by X-ray crystallographic analysis of an archaeal peroxiredoxin (Prx) from *Aeropyrum pernix*. Hydrogen peroxide converted the active site cysteine residue to a sulfurane derivative, a hypervalent sulfur compound, in which the sulfur atom is covalently linked to the nitrogen atom of the neighboring histidine residue. This study provides the first evidence that a hypervalent compound occupies an important position in biochemical process.

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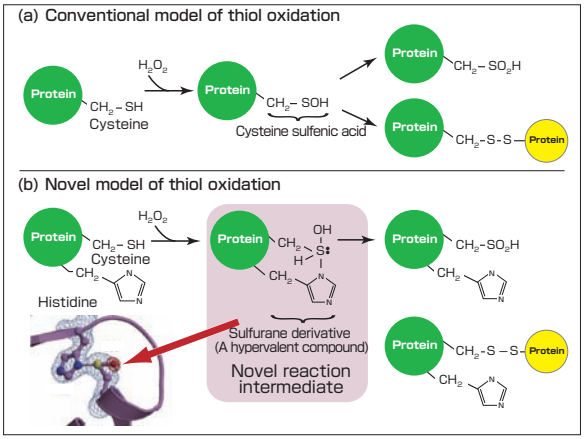

Reaction mechanism of thiol oxidation
Novel reaction mechanism through a hypervalent compound

Robot simulator "OpenHRP3"

A common software platform for efficient development of the next-generation robots

To make the development and operation of robots safe and efficient, it is necessary to simulate motions of the robots using a computer before the robots are operated in the real world. To this end, we have developed an integrated robot simulation system called "OpenHRP3 (Open-architecture Human-centered Robotics Platform 3)". OpenHRP3 can simulate physical motions of various types of robots including arm robots, mobile robots with wheels and humanoid robots. OpenHRP3 can also simulate the view images obtained from cameras or range sensors. We are distributing OpenHRP3 under an open-source license.

We have developed efficient, accurate algorithms for computing the forward dynamics of rigid bodies. The forward dynamics engines based on the algorithms allow practical simulations even for complicated motions of robots. In addition, the architecture of OpenHRP3 intends to be a common software platform for developing various robot software components in a unified manner based on the "RT-Middleware". These characteristics of OpenHRP3 can promote the efficient development of next-generation robots.

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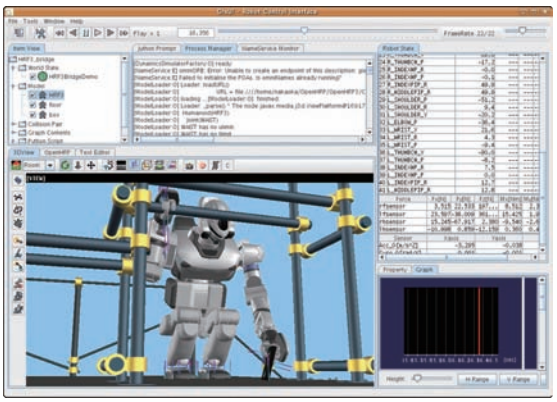

Simulation view image of OpenHRP3