More effective method of imaging proteins

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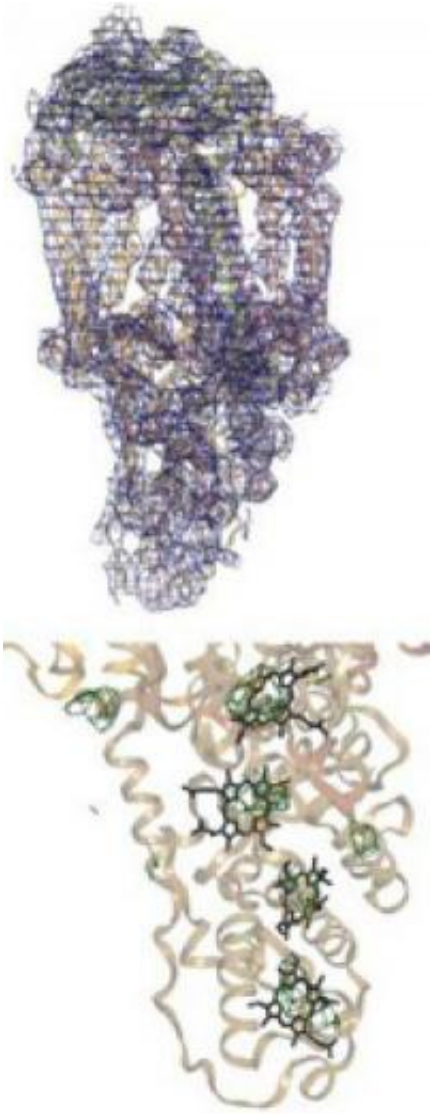

Using a unique facility in the US, researchers at the University of Gothenburg have found a more effective way of imaging proteins. The next step is to film how proteins work -- at molecular level. Credit: Photo: University of Gothenburg

Using a unique facility in the US, researchers at the University of Gothenburg have found a more effective way of imaging proteins. The next step is to film how proteins work – at molecular level.

Mapping the structure of proteins and the work they do in cells could be the key to cures for everything from cancer to malaria. Last year Richard Neutze, professor of biochemistry at the University of Gothenburg, and his research group were among the first in the world to image proteins using very short and intensive X-ray pulses.

In a new study published in *Nature Methods*, the method has been tested on a new type of protein, with good results.

"To put it simply, we've developed a new method of creating incredibly small protein crystals," says Linda Johansson, doctoral student at the Department of Chemistry and Molecular Biology and lead author of the article. "We've also shown that it's possible to use very small crystals to determine a membrane protein structure."

Could become standard

There are two major challenges when it comes to imaging proteins: the first is to create the right sized protein crystals, and the second is to irradiate them in such a way that they do not disintegrate. Although Sweden has a facility for synchrotron-generated X-ray radiation – Maxlab in Lund – this type of technology is not sufficiently light-intensive and therefore requires large protein crystals which take several years to produce.

Richard Neutze was one of the researchers to float the idea that it might be possible to image small protein samples using free-electron lasers which emit intensive X-ray radiation in extremely short pulses – shorter than the time it takes light to travel the width of a human hair. This kind

of facility has been available in California since 2009, and it is this facility that was used for the study.

"Producing small protein crystals is easier and takes less time, so this method is much faster," says Linda Johansson. "We hope that it'll become the standard over the next few years. X-ray free-electron laser facilities are currently under construction in Switzerland, Japan and Germany."

365,000 images

Carried out by researchers from Sweden, Germany and the US, the study investigated a membrane protein from a type of bacterium that lives off sunlight. It is important to investigate membrane proteins as they transport substances through the cell membrane and thus take care of communication with the cell's surroundings and other cells.

"We've managed to create a model of how this protein looks," she says. "The next step is to make films where we can look at the various functions of the protein, for example how it moves during photosynthesis."

A key discovery was that far fewer images are needed to map the protein than previously believed. Using a free-electron laser it is possible to produce around 60 images a second, which meant that the team had over 365,000 images at its disposal. However, just 265 imageswere needed to create a three-dimensional model of the protein.

Provided by University of Gothenburg