'Molecular movies' to reveal the dynamic lives of proteins

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Capturing moving images of tiny protein molecules is the aim of a new research project announced today at Imperial College London. The research will reveal, on extremely short timescales, the miniscule movements of proteins which help carry out important biological processes in people, animals, insects and plants.

The one million euro study, funded by the European Research Council, will focus on one particular group of proteins called light receptor proteins. Researchers will examine what happens when these proteins are hit with a pulse of bright laser light, and will record moving images of the results.

Light receptor, or 'photoreceptor', proteins trigger important biological responses to light. The human photoreceptor proteins which the researchers will study are involved in maintaining the body's internal 24 hour clock which governs sleep cycles in relation to day and night, and have significant biomedical importance.

The researchers will also study plant light receptor proteins which help plants bend towards the sun, and are involved in photosynthesis - the process by which sunlight is converted into energy.

The new funding will allow scientists to bring together two different types of imaging technology to look at both vibrations and motions on extremely short timescales, for the first time in the UK. This will enable the scientists to record how the molecular structures of these types of

proteins change when they are 'at work'.

Recipient of the new grant, Dr Jasper van Thor from Imperial College London's Department of Life Sciences, explains why capturing dynamic 'movies' of these proteins is important:

"Although much is known about the structure of these types of proteins when they're in a static state, few experiments have been carried out to understand exactly what happens on a molecular level when they're 'activated' by light and start moving around doing their jobs.

"We hope that getting a dynamic, moving picture of how these proteins work will give us a greater understanding than ever before of how these important biological processes happen."

Dr van Thor's grant will be used to fit out a new laser laboratory at Imperial for 'pump-probe' experiments. In these experiments, the light receptor protein molecules will be stimulated, or 'pumped', into activity by a laser, and then their movements and structural changes recorded by a very fast spectroscopic 'probe' for analysis.

This probe will give the scientists a moving image which will reveal more about the structure of the proteins than a stationary snapshot would.

The second type of technology that Dr van Thor and his colleagues will use to capture images of the proteins in action is extremely powerful x-rays produced in synchrotron facilities. In these experiments, the scientists will again use a laser pump to activate the proteins, but here they will use a very fast pulsed x-ray probe to record to the moving images. The combination of these two techniques will give Dr van Thor a comprehensive set of moving images of the light receptor proteins at work.

Professor Paul Freemont, Head of the Division of Molecular Biosciences in which Dr van Thor is based, said: "Jasper's outstanding work brings together physics, chemistry and biochemistry, illustrating the strength of interdisciplinary research within the life sciences at Imperial. I'm delighted that the European Research Council has awarded him this funding to probe the molecular mechanisms of life in such exquisite detail."

Source: Imperial College London