A protein's life, up close and personal

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(Phys.org)—An EPFL team has developed a technique for spying on the inner lives of cells. For the first time, scientists have used a near-infrared, light-sensitive biocompatible molecule to mark and observe the activity of proteins inside living cells.

Proteins are the building blocks of all life, responsible for innumerable functions in cells, including communication, structural maintenance and mobility. But they're quite difficult to study. One method is to observe their distribution and work they do inside living cells. Now EPFL scientists have, for the first time, used a molecule that can penetrate the cell membrane, attach to proteins and then shine when exposed to near-infrared light. This development will make it possible to probe living tissues without damaging them and will reveal, in real time, the biochemical processes that are taking place.

Just light enough

Thanks to genetics and chemistry, EPFL scientists were able to attach membrane-penetrating, near-infrared-sensitive molecules to proteins inside a cell, without causing any damage to the cell in the process. The challenge of studying proteins in vivo is that living tissue is both fragile and opaque to certain light spectra. Up to now, researchers had to force light in order to see fine detail or pass through the thickness of the tissue. But the wavelengths of light used are harmful at high doses.

With funding from the NCCR Chemical Biology, a team led by Suliana Manley from EPFL's Laboratory of Experimental Biophysics and Kai

Johnsson from EPFL's Laboratory of Protein Engineering has realized a long-held dream in biology. They have developed a fluorescent substance - a "fluorophore" - that can penetrate the cell membrane, react to near-infrared radiation and make proteins shine unusually brightly, thus making it easy to observe them using a microscope.

A promising technique

"The advantages of the molecule that we've developed are that it's stable, easy to couple to proteins and shines strongly enough," explains Gražvydas Lukinavičius. "People have been trying for about a decade to develop a molecule like this that can enter into living cells in order to observe tissues in depth," adds his colleague Kai Johnsson.

Thanks to this molecule, the chemists have obtained promising results. In particular, they were able to apply the "super-resolution" method, in which a mathematical treatment is used to improve image resolution. With this method, the tiniest details visible in living tissues are thus about 50-60 nanometers, four times better than using a conventional microscope. This technique also allows images to be taken very rapidly, in order to recreate three-dimensional images or animations that reveal the processes taking place.

More information: lip.epfl.ch/
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