New dye allows super-imaging of cells

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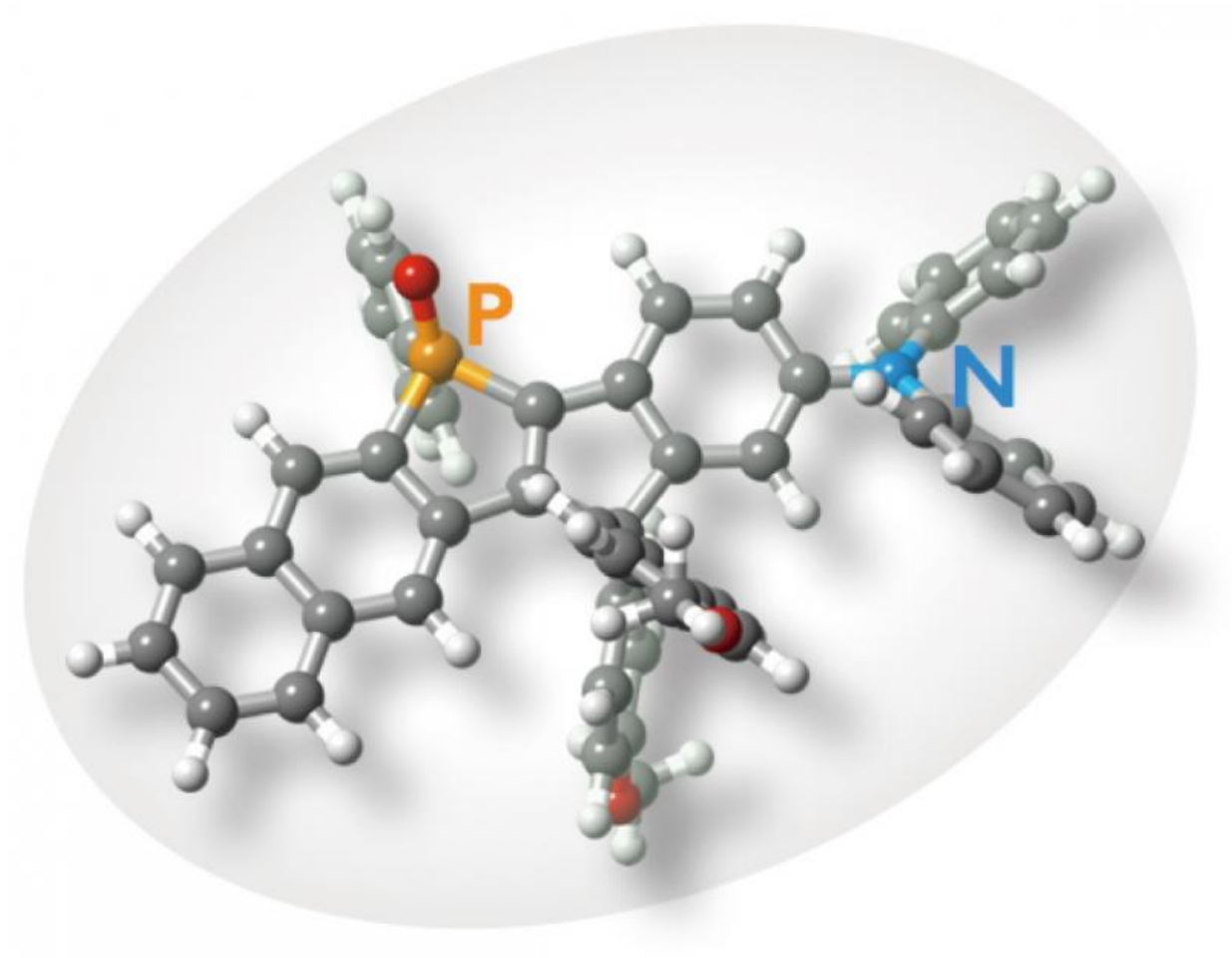


Molecular structure of C-Naphox. Credit: Institute of Transformative Bio-Molecules (ITbM)

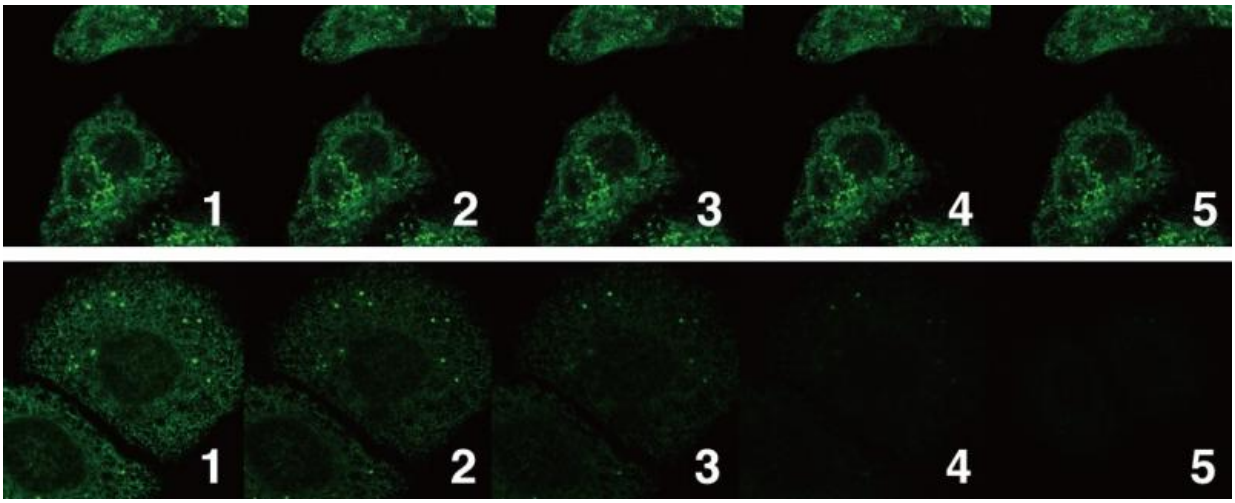
A new dye might allow researchers to view natural processes in

extremely small components of living cells over a prolonged period of time; a previously unattainable feat.

Optical microscopy allows researchers to see and distinguish between objects that are about 200 nanometres (nm) apart. In comparison, a human hair is about 90,000 nm thick. Unfortunately, most objects of interest in biology, such as organelles in cells and proteins, are much smaller than 200 nm.

Biologists have been looking for ways to improve the resolution of microscopes, pioneering the field of super-resolution microscopy. Stimulated emission depletion (STED) microscopy is one such improvement: a source of light focuses on a point of interest while the surrounding zone is kept in the dark and toned down, so to speak, using a special laser to form a background without interferences. This technique is fluorescence-based, using special dyes to tag the cells or structures of interest.

STED microscopy is very effective, allowing researchers to detect objects that are only tens of nanometres apart. However, it does come with its own set of challenges: most importantly, that the special laser used to tone down the background is, counter-intuitively, very intense. Not many dyes can withstand this intensity without losing fluorescence so quickly that only a few images can be taken, which is much too fast for the needs of researchers.



(Above) STED microscopy images of cells with C-Naphox remained stable. (Below) STED microscopy images with a commercially available compound. Credit: Institute of Transformative Bio-Molecules (ITbM)

Professor Shigehiro Yamaguchi and Professor Tetsuya Higashiyama from the Institute of Transformative Bio-Molecules at Nagoya University in Japan have developed a dye, called C-Naphox, that, thanks to a carbon-bonded structure, is very stable and does not dim even under the harsh conditions of STED microscopy. It is also non-toxic, so it can be used in live cells.

The researchers found that the dye remained stable after two hours of irradiation. When taking multiple images in succession—a key part of super-resolution microscopy as it allows researchers to follow live cells undergoing their natural processes over time—the team found that C-Naphox remained stable after five images. Even after taking 50 images, more than 80 percent of the C-Naphox signal remained. In comparison, one of the best options available commercially, a compound called Alexa 488, dimmed almost to invisibility after taking only five images. Once widely available, C-Naphox should enable prolonged recording of live

cells using STED microscopy; a previously unattainable feat.

Provided by Nagoya University