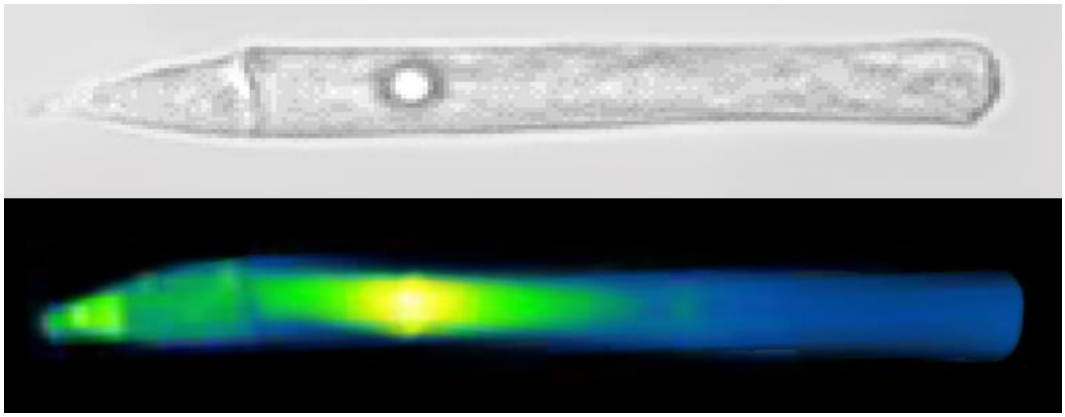
**PRESS RELEASE**

# Not just light: the sensitivity of photoreceptors to mechanical stimuli is unveiled

**Thanks to *optical tweezers,* a new study reveals unexpected properties of the neurons responsible for the transduction of light signals. The research has been published in *PLOS Biology.***



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“We thought we knew almost everything about photoreceptors, but we have proved that is not the case.” With these words, Vincent Torre, Professor of neurobiology of SISSA – Scuola Internazionale Superiore di Studi Avanzati, comments the results of a new study that, thanks to a multidisciplinary approach and to the use of *optical tweezers,* reveals for the first time the sensitivity of nerve cells present on the retina to mechanical stimuli and opens up new questions on how they function. The work has been published in *PLOS Biology*.

Cones and rods, also known as photoreceptors. It is thanks to them that the light that reaches our eyes transforms into information. They are cells with a characteristic shape, as the names suggest, mutually complementary. If the cones are principally involved in daytime vision and colour recognition, the rods on the other hand are very sensitive to light and allow to see even in low-light conditions.

The mechanisms for transduction of light signals have been known for some time, but the development of new experimental methodologies inspired by nanotechnology has allowed a group of researchers of SISSA, the National Research Council (CNR) and the Australian National University to better understand the complexity of their functioning.

In particular, scholars have investigated the mechanical sensitivity of frog rods using *optical tweezers*. “This highly innovative technique uses an infrared laser beam to trap particles of very small dimensions and handle biological systems with extreme precision without damaging them” explains Dan Cojoc, head of the *Optical Manipulation Laboratory* of the ‘Istituto Officina dei Materiali’ of CNR. In this way the scientists could apply a slight pressure to the surface of isolated rods, while monitoring the response with *calcium imaging* techniques, which allows to detect the concentration of intracellular calcium through the presence of fluorescent molecules. They observed consistent variations in fluorescence thus showing an unexpected sensitivity of the photoreceptors to the mechanical stimuli.

In line with this interpretation, the research team, which included SISSA PhD students Ulisse Bocchero, Fabio Falleroni, Simone Mortal and Yunzhen Li, ascertained the presence in photoreceptors of specific molecules sensitive to mechanical stress. They detected a variation in electrical signals in the presence of drugs able to block the functionality of some of these molecules and, then, analysed their distribution in the retina through specific fluorescent markers. Finally, they demonstrated the existence in vertebrates of an association between the genes connected to phototransduction and some genes connected instead to mechanical transduction.

What are the physiological mechanical stimuli able to activate the photoreceptors? “It is still an open question,” answers Torre. “Thanks to the *optical tweezers* we have shown the sensitivity of the rods to mechanical stimuli. However, we have also been able to observe a reduction in the length of their external segment when subjected to particularly intense light flashes, a phenomenon known as phototropism. In situations like these, it is more than plausible to think that mechanical stimulations are involved.”

Undoubtedly, there are still many steps to understand: “We believe that sensitivity to mechanical stimuli is necessary to guarantee both cell integrity and optimal functioning of phototransduction,” concludes Torre. “Once again, biology shows that there is always a greater complexity and it is incredible how the development of new technologies allows us to discover new things all the time.”

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**Paper**: https://bit.ly/3hnWpI0

**IMAGE**
“Mechanical stimulation of a photoreceptor with optical tweezers.” At the top, a trapped bead on the outer segment of a rod. At the bottom, the corresponding fluorescence change.

Credits: Bocchero et al.

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