Nanowire arrays help blind mice see again

With the support by the National Natural Science Foundation of China, the research teams directed by Prof. Zheng GengFeng (郑耿锋) and Prof. Zhang JiaYi (张嘉漪) in the Laboratory of Advanced Materials and Institute of Brain Science at Fudan University, recently reported the restoration of vision in blind mice using artificial photoreceptors made of arrays of the gold-coated titanium dioxide nanowires, which was published in *Nature Communications* (2018, 9: 786).

Human retina is a multilayered structure of neurons with different functions, and the photosensitive layer is known as photoreceptors, which can capture and transfer the light information into neural activity. The loss of these photoreceptors either during development or under degenerative disease conditions can lead to irreversible loss of vision.

In this work, Zheng et al. developed a photoresponsive nanowire array that can be implanted subretinally to replace impaired photoreceptor cells of a blind retina, which functions as an artificial photoreceptor to relay the light information into the rest of the retina and the brain thereafter, thus restoring the vision. These nanowire array devices are thin enough so that it can be implanted at the bottom of an eye. After implantation of the nanowire arrays, these devices can absorb the incident light into eyes, and transform photons into photocurrent, in an analogy of a photovoltaic cell. The photocurrent can subsequently excite the bipolar and ganglion cells in a retina, which further transfer light information into the brain. In addition, not only the photoresponses of photoreceptor-degenerative retinas were recovered, but the light sensitivity of awake-behaving mice was also restored, such as pupillary light reflex.

These findings open up new possibilities for clinical treatment of blindness from retinitis pigmentosa or age-related macular degeneration. The subretinal implant surgery for patients is an established clinical procedure, and the biocompatibility of gold is shown to be suitable for chronic implant. They will continue to work on improving the sensitivity of the nanomaterial, test long-term biocompatibility, as well as exploring possibilities for clinical translations.

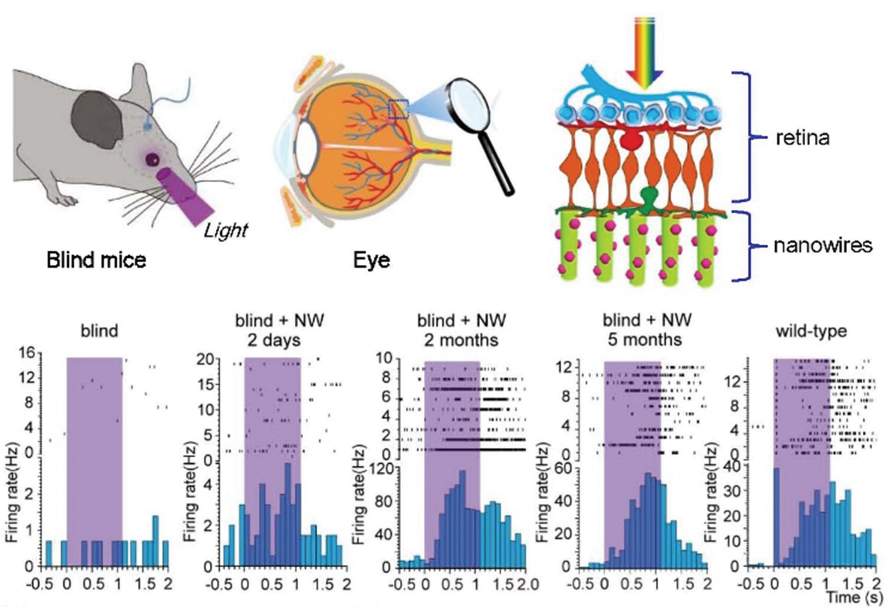

Figure (Top) Design of artificial photoreceptors by Au-coated TiO_2 nanowires. (Bottom) The recovery of light response (represented by the recovery of action potentials in the visual cortex over light exposure) for blind mice 2 days, 2 months and 5 months after the implant of nanowires.