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Retina Image Formation Enhancement through Active Nanoparticle-based Photoreceptors

Active nanoparticle-based photoreceptors restoring vision by enhancing edge detection and image processing in blindness.

7 million people in the world experience either partial or full blindness, and statistics from 2010 show that in the US, more than 3 million people suffer from this condition. The underlying cause of blindness is overwhelmingly due to retinal diseases, which lead to a loss of healthy photoreceptors (PRs) found within the retina. However, it is possible to stimulate healthy PRs to regain some vision. Artificial PRs (APRs) currently require image capture via a camera that is then processed by nanodevices to stimulate healthy PRs. Each image contains lots of information, which slows the processing time down, and APRs are easily saturated, which leads to a whitewashed image. Thus, there is a need for a novel APR and operating system to effectively process images in real-time for people suffering from partial or total blindness. Researchers at Purdue University have designed controllable multi-core APRs to excite retinal cells on demand and create images of object edges with increased spatial resolution and faster processing times. This technology allows for partial restoration of vision with minimal saturation of images and can potentially be used in or with other vision restoration strategies to maximize vision for those suffering from partial or full blindness.

Technology Validation:

-Transmission electron microscopy (TEM) and Dynamic Light Scattering (DLS) show morphology of nanoparticles

-Fluorescent imaging technique used to image electrical charges generated by APRs

-Mice pupillary light reflex (PLR) measurements performed and show recovery of pupillary response post injection of APRs

Technology ID
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Category
Materials Science & Nanotechnology/Biomedical & Bioinspired Materials
Digital Health & Medtech/Implantable Medical Devices

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-Longitudinal optical coherence tomography (OCT) shows deposition of APRs on mice retinas and stimulation of APRs

-Proliferation and cell apoptosis assays show no toxicity when mice injected with APRs

-Co-incubation of APRs with human ganglion cells shows activity in response to stimulation

Advantages

-Not toxic

-Facile synthesis of nanoparticles and electrodes

-Minimal saturation of images

-Faster processing time

Applications

-Partial or full vision restorative therapeutics

TRL: 5

Intellectual Property:

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Keywords: Artificial Photoreceptors, Biomedical Engineering, Blindness, Electrode Synthesis, Micro & Nanotechnologies, Nanoparticles, Photoreceptors, visual impairment