Low cost printed artificial retina

THE UNIVERSITY OF SYDNEY

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Medical technology and devices

> TRL 3-4

Executive statement
Innovative organic semiconductor nanoparticles designed to mimic human retinal photoreceptors for advanced retinal prosthetic applications.

Solution
This technology provides organic semiconductor compositions comprising nanoparticulate organic electron donor-acceptor materials whose optical absorbance spectra overlap with those of human retinal photoreceptors. These nanoparticles can incorporate therapeutic agents such as neuroprotective factors and anti-inflammatory drugs, enabling fabrication of flexible, biocompatible retinal prosthetic devices that interface directly with retinal neurons without requiring external power or signal processing.

Intellectual Property Status
Provisional application 2025900616

Key advantages
- Low manufacturing cost with scalable nanoparticle production methods.
- Direct coupling to functional retinal neurons, optical nerves, and visual cortex for effective vision restoration.
- No need for complex external signal processing or power sources.
- Flexible, biocompatible substrates that mimic the natural retina's softness and curvature.
- Capability to restore color vision by matching absorbance spectra of short, medium, and long wavelength cone photoreceptors.
- Incorporation of neurotrophic and therapeutic agents to enhance neuron attachment, growth, and reduce inflammation.
- Improved exciton splitting efficiency due to intermixed donor-acceptor nanoparticles enhancing device performance.

Problems solved
- Limitations of brittle, silicon-based retinal implants causing discomfort and image distortion.
- Challenges in achieving biocompatibility and integration with retinal tissue.
- Need for bulky external power and signal processing components in existing devices.
- Inadequate exciton dissociation and charge generation in traditional organic semiconductor films.
- Difficulty in delivering therapeutic agents directly within retinal prosthetic materials.

Market applications
- Retinal prosthetic devices for treatment of age-related macular degeneration (AMD), diabetic retinopathy, retinitis pigmentosa, and other vision impairments.
- Implantable organic semiconductor devices for neural interfacing and vision restoration.
- Biomedical devices combining organic electronics with drug delivery for neuroprotection and anti-inflammatory therapy.
- Flexible, biocompatible electronics for ophthalmic and neural prosthetics.
- Advanced materials for next-generation optoelectronic implants in healthcare.

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