

Nanotechnology for Vision Restoration

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Abstract— Degenerative retinal dystrophies, such as retinitis pigmentosa and age-related macular degeneration, cause the progressive loss of retinal photoreceptors, which leads to blindness. Thus far, pharmacological treatments have failed to cure or effectively block the progression of these diseases. One possible solution is to replace photoreceptors with retinal prostheses; however, inorganic electronic devices have not yet achieved satisfactory results in replicating natural vision. Nanotechnology, benefitting from low invasiveness and wireless stimulation, may overcome many of the challenges presented by electronic retinal devices. In particular, nanoparticles can be engineered to harvest and transduce light energy into bioelectricity, mimicking the behaviour of natural photoreceptors.

Guglielmo Lanzani is a physicist. Full professor at Politecnico di Milano, he has served from 2010 to 2023 as Director of the Center for Nano Science and Technology at Italian Institute of Technology, where he is senior researcher. He studies photoresponsive materials able to induce light sensitivity and signaling in biological systems. The ultimate goal is to realize photo-driven human-machine interfaces for application in regenerative medicine, prosthetics and hybrid robotics. He has recently developed, in collaboration with neuroscientist and medical doctors, a new retina prosthesis that exploit semiconducting polymer nanoparticles for rescuing vision in photodetector-degraded retinas. He is a founding partner in two start-ups (NOVAVIDO, and SAMS Technology).

