Design and validation of a foldable and photovoltaic wide-field retinal prosthesis

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In the last two decades, several retinal prostheses have been developed to fight blindness in people affected by outer retinal layer dystrophies. To date, a few hundred blind patients worldwide have received retinal implants. In this field, one of the most important open questions concerns how to increase both visual acuity and visual field with the same device.

Here we present a novel foldable and photovoltaic wide-field retinal prosthesis that advances the current state of the art in several aspects. The active array covers a retinal surface of 13 mm in diameter, affording restoration of the visual field up to ~44 degrees. Moreover, it is foldable to limit the scleral incision and it self-opens once released into the eye. It has a hemispherical shape to match the curvature of the eye, thus remaining in tight contact with the retina and minimizing the distance between the electrodes and the retinal cells over its entire surface. Lastly, it operates according to a photovoltaic principle via 2345 stimulating pixels. In its central area of 5 mm it embeds 1067 pixels, twice than the estimated value required for being useful in daily activities.

Laboratory tests show that the prosthesis is not cytotoxic, while accelerated ageing shows a lifetime of at least 2 years. These advances provide a realistic solution towards the improvement of both visual acuity and visual field in blind patients.