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### **Visual restoration by retinal prostheses and optogenetic therapy: Validation in non-human primates**

Following photoreceptor loss, electrical activation of residual retinal neurons can restore some visual function in blind patients. However, the perception provided by current devices does not allow face recognition or autonomous motion in an unknown environment. At the Vision Institute in Paris, we have assessed new photovoltaic retinal implants and optogenetic therapy on non-human primates to improve further current strategies for restoring vision. Using photovoltaic implants, individual retinal ganglion cells were activated by infrared activation of a single 100 $\mu$ m pixel and not by its neighbors indicating thereby high resolution of the device. In vivo, photoreceptors were found to degenerate below the implant due to the retinal detachment from the retinal pigment epithelium. Behavioral studies confirmed the presence of a blind spot upon normal visual stimulation at the implant position. However, infrared stimulations at the implant position induced saccades indicating thereby visual perception generated by the infrared sensitive implants. In parallel, microbial opsins were expressed in the non-human primate retina through gene therapy. Activation of the retinal ganglion cells with patterns and short pulse durations (1-10 ms) demonstrated the potential use of this strategy for visual restoration up to 6 months post injection. These new results demonstrate efficacy on non-human primates for both photovoltaic implants and optogenetic therapy paving their ways towards clinical trials.

### **Biography**

Serge Picaud director for Institut de la Vision, Team Leader - Retinal information processing: Pharmacology, toxicology, pathologies. Founder in Fovea Pharmaceuticals, Founder in Pixium Vision, member of the scientific committee for the Federation des Aveugles de France, member of the administrative committee for the Fondation Voir et Entendre, member of the CNRS committee for the section 25, member of ANR funding committee, member of AERES Committee.

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