Three senior post-doctoral position in "*Hybrid strategies for visual restoration"* at the Center for Synaptic Neuroscience and Technology, the Italian Institute of Technology, Genova, Italy

The Center for Synaptic Neuroscience and Technology (https://www.iit.it/it/nsyn-unige/) of the Italian Institute of Technology (IIT; https://www.iit.it/) in Genova is opening three Senior Postdoc positions under the supervision of dr. Fabio Benfenati in the field of advanced neural interfaces for neuronal photostimulation and their application for restoration of vision in neurodegenerative diseases of the retina, such as Retinitis pigmentosa and macular degeneration (research line: Neuroscience and Smart Materials).

In the recent years, we have pioneered active light-sensitive interfaces for neuronal stimulation using organic electronics (*Nature Materials* 2017; *Nature Nanotechnology* 2020a; *Nature Reviews Materials*, 2020; *Nature Nanotechnology* 2021*Nature Communications 2022)* and photochromic compounds (*Nature Nanotechnology* 2020b; *Adv. Sci.* 2020; *Nanomedicine* 2020). Moreover, an advanced version of the polymer-based prosthesis as an injectable "*liquid prosthesis*" made of nanoparticle (NP) suspensions has been developed. These technologies are quickly evolving from a proof-of-principle stage to real prostheses implanted in rodent and pig models of degenerative blindness.
The research projects supported by grants from the **Telethon Foundation, Italy** and the **Italian Ministry of Health** are the following:
1. Hybrid electrical synapses for wireless photostimulation. We demonstrated that polymeric NPs form "electrical synapses" with target neurons that are capacitively depolarized to rescue vision in animal models of Retinitis pigmentosa (RP). To make photostimulation cell-specific, we plan to functionalize NPs with recombinant antibodies targeting mGluR6, a unique marker of ON-bipolar cells. This would allow targeting the ON-pathway in a gene-free fashion and restoring the ON/OFF-signature of retinal processing responsible for spatial resolution and contrast sensitivity. We will also exploit the effects of polymeric NIR-sensitive NPs in the brain to stimulate denervated neurons on demand.
2. Membrane-targeted photochromic compounds for neuronal photostimulation. The project aims at investigating novel intramembrane, azobenzene-based actuators that elicit light-triggered neuronal stimulation. The actuators dwell into the membrane and behave as light-driven molecular machines that bidirectionally perturb the membrane, impacting on its passive and active properties and eventually on neuronal excitability. We will exploit these compounds for brain and retina with nanostructures capable of slow and prolonged release in the nervous tissue. In the retina, preliminary ex-vivo evidence shows that these bifunctional compounds successfully recreate the mosaic of ON and OFF cells that generates visual acuity and contrast sensitivity, representing a very interesting solution for transferring this strategy to RP patients.

The experimental work will involve:
(i) engineering single chain variable fragment (scFv) antibodies to functionalize nanoparticles for specific targeting;

(ii) functional testing of functionalized NPs and novel photochromic compounds *in vitro* on primary neurons, *ex vivo* retinal explants and retinal organoids using cellular electrophysiology techniques such as patch-clamp and high-density multielectrode arrays;
(iii) in vivo studies in experimental models of retinal degeneration including in vivo electrophysiology, functional 2-photon imaging and study of the light-driven behaviors.

The successful applicant should have a PhD in Biotechnology, Molecular Biology, Neuroscience or similar. An in-depth expertise in molecular and cellular biology, stem cells and retina organoid engineering, ex vivo electrophysiology or *in vivo* functional studies will be greatly appreciated. **The positions can range from 2 to 3 years**. Salary and benefits are competitive for international standards.

Please submit your application, including a detailed curriculum, 3 representative publications and one-page research statement in PDF format to fabio.benfenati@iit.it (and rossana.ciancio@iit.it in cc) quoting "*Senior postdoc positions in hybrid photostimulation strategies for visual restoration"* in the subject line. Candidates must also request reference letters to be sent directly in PDF format to fabio.benfenati@iit.it (and rossana.ciancio@iit.it in cc) by the Referees.