HORIZON 2020

BRInGing nano-pHoTonics into the brain

Rapports

Informations projet

NanoBRIGHT

N° de convention de subvention: 828972

Site Web du projet

DOI
10.3030/828972

Projet clôturé

Date de signature de la CE
17 Decembre 2018

Date de début
1 Mai 2019

Date de fin
30 Avril 2024

Financé au titre de
EXCELLENT SCIENCE - Future and Emerging Technologies (FET)

Coût total
€ 3 496 197,50

Contribution de l'UE
€ 3 496 197,50

Coordonné par
FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA
Italy

Periodic Reporting for period 4 - NanoBRIGHT (BRInGing nano-pHoTonics into the brain)

Période du rapport: 2023-05-01 au 2024-04-30

Résumé du contexte et des objectifs généraux du projet

NanoBRIGHT aimed at developing novel cutting-edge optical approaches to study and treat pathological conditions of the brain without using genetically-encoded proteins. This was achieved by developing a new generation of optical neural interfaces to bring plasmonics to the living brain. NanoBRIGHT has sought to develop low-invasiveness devices able to exploit unconventional combinations between optics and photonics to interact with the brain tissue, bringing light to control and monitor physiological phenomena not accessible with currently available techniques. This has generated new knowledge on brain diseases, as well as new technological paradigms for next generation devices to interface with the neural tissue without requirement for genetic modification.

Travail effectué depuis le début du projet jusqu'à la fin de la période considérée dans le rapport et principaux résultats atteints jusqu'à présent

At the end of the end of the project the consortium has advanced scientific knowledge and neurotechnologies by:
- Developing fabrication methods to realize plasmonic structures on tapered fibers (including a wide field-of-view two photon lithography system)
- Implementing novel numerical design of the plasmonic structures
- Implementing Novel numerical methods to estimate electromagnetic field on the edge of optical fibers
- Developing optical methods to obtain spatial resolution for both flat-cleaved and tapered fibers-based endoscopes
- Implementingf Raman Systems in neuroscience and cancer neuroscience labs and their combination with electrophysiology system
- Developing models of diseases to obtain simultaneous Surface Enchanted Raman Signals, optical readout of neural activity and electrophysiology
- Developing of models of diseases to investigate the permeability of the blood-brain-barrier
- Engineering Light–Matter Interactions on the Nonplanar Surface of Tapered Optical Fibers, proposing Plasmonics on a Neural Implant
- Implementing Holographic Manipulation of Nanostructured Fiber Optics Enables Spatially-Resolved, Reconfigurable Optical Control of Plasmonic Local Field Enhancement and SERS
- Obtaining SERS Detection of Neurotransmitters through Gold-Nanoislands-Decorated Tapered Optical Fibers with Sub-10 nm Gaps, with a limit of detection as low as 10-6 M
- Developing Machine learning methods to identify experimental brain metastasis subtypes based on their influence on neural circuits

Obtained so far have been published in peer-reviewed scientific journals and presented to international scientific conferences. NanoBRIGTH got ample coverage in press media, radio and television of Italy, Spain and France along this first year.

Progrès au-delà de l'état des connaissances et impact potentiel prévu (y compris l'impact socio-économique et les conséquences sociétales plus larges du projet jusqu'à présent)

By virtue of its cross-disciplinary approach and high translational appeal, NanoBRIGHT has provided new scientific knowledge and new technological breakthroughs with the potential to establish a new paradigm in the investigation and treatment of brain diseases. The project provided the nano- and micro-fabrication community with a novel technology for patterning non-planar widely-extended surfaces and integrating plasmonic metamaterials. This has allowed to get the lowest limit of detection for neurotransmitters through an optical fiber in a lable-free fashion. The possibility of using the devices that are being developed at both single-cell and population-wide spatial scales will allow neuroscientists to design new cutting-edge experiments to get new insights on the nature of brain tumors, evaluate the molecular nature of brain diseases including brain injuries and investigate the mechanisms for peritumoral epileptogenesis. These technology-enabled new insights in brain diseases will generate important translational applications, including novel photonic and electrophysiological devices to avoid biopsies, improved specificity of chemotherapic drug release into brain and identifying early biomarkers for peritumoral epileptogenesis.

Project Logo

Dernière mise à jour: 11 Novembre 2024

Permalink: https://cordis.europa.eu/project/id/828972/reporting/fr