ICFO

Red Light for Blue Babies

The European project Tiny Brains aims to develop an optical neuroimaging device for assessing brain damage in infants born with severe congenital heart-defects.

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Every year, about a million babies (50,000 in Europe) are born with congenital heart-defects (CHD), a structural defect that can drastically affect the life of a child and their families. About 25% of the babies born with CHD need immediate surgery or other invasive treatment within the first year of life. Over the last decade, the survival of babies born with CHD has increased greatly, with more than 85% of them reaching adulthood. However, about 30% of these children will have neurodevelopmental disabilities, which can range from mild impairments in cognition to severe neurologic deficits. Learning disabilities are now one of the most frequent sequelae among CHD infants. Thus, CHD has become a major cause of socio-economic burden for patients, families and the Health Care System. Studies have shown that these neurodevelopment disabilities arise because of ongoing brain injury due to periods of insufficient oxygen delivery to the brain from the fetus life to early childhood . To change the natural course of the disease and to prevent brain injury in CHD infants, an

in-depth analysis of the mechanisms of injury combined with innovative technology that seeks to develop new monitoring tools is urgently needed.

As Marta Camprubi and Joan Sanchez-de Toledo, clinicians at the Hospital Sant Joan de Deu, Barcelona and researchers from the Institut de Recerca Sant Joan de Deu (IRSJD) remark, i¿½Being able to understand what is happening within these vulnerable brains, at any giv n time and why will help us find new strategies to protect them, and improve their neurologic l development.i¿½

The immature newborn brain is very different compared to that of the adult. Therefore, the underlying mechanisms that cause this injury and the subsequent development of new neuromonitoring and treatment strategies are different from adult patients. This becomes even more challenging when we are dealing with the vulnerable brain of a premature infant.

The European project Tiny Brains aims to develop an advanced photonics-based neuro-imaging device for infants, using a multi-modal approach to understand the mechanisms underlying brain damage in CHD patients. It intends to provide a research platform to improve the understanding of the cellular origin of the brain injury by enabling the assessment of the link between energy demand and oxygen supply.

Coordinator of the project ICREA Prof. at ICFO Turgut Durduran comments, i¿½The u e Near-infrared light to probe the well-being of the brain is a very promising method. t provides critical information; it is non-invasive and portable. When combined wi h electrophysiology, we can use it to understand mechanisms of injury at a cellular level a d develop cot-side devices to raise an alarm to prevent injuryi¿½.

It will combine advanced biophotonics technologies and electroencephalography into a disruptive research tool to measure cerebral hemodynamics, oxygen metabolism and electrophysiology simultaneously. In vivo imaging in three-dimensions, i.e. tomography will greatly increase the brain specificity and penetration as well as, for the first time, providing spatial resolution to this class of measurements.

A consortium of six partners will work together for the next 4 years and includes the following entities: ICFO (Coordinator, Spain) and the University de Picardie Jules Verne (France) as technology developers in academia; the Research Institute of Sant Joan de Deu ? the Sant Joan de Deu Hospital Barcelona (Spain) for pre-clinical and clinical testing; an HemoPhotonics (Spain), BioPixS (Ireland), and Seenel Imaging (France) as industrial partners.

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Tiny Brains