Discussing photonics tools for pediatrics in the 3rd BMPN annual meeting

A gathering of experts focuses discussion on photonic techniques to improve diagnostics and treatment personalization in pediatrics

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On Wednesday 17th of April, the Barcelona Medical Photonics Network (BMPN) celebrated the third edition of its annual meeting. The BMPN formally launched in March 2021 as a platform to promote the research and development activities in photonics being carried out in the Barcelona region through long-standing collaborations between ICFO and its biomedical and clinical partners. This year's edition was co-organized with ICFO's two main medical partners in the field of Pediatrics: Sant Joan de Deu Barcelona Children's Hospital (SJD), where the event was held, and Vall Hebron University Hospital, as well as their respective research institutes.

The speakers reviewed different imaging and monitoring photonic techniques and their recent and ongoing applications in several medical fields, with special attention to brain

pathologies and neurodevelopment in pediatrics. The session started with **Dr. Joan Comella**, director of Research, Innovation and Learning at the SJD Barcelona Children's Hospital and Director of the Institute of Research Sant Joan de Deu (IRSJD). Dr. Comella introduced the event highlighting the fundamental goal of their institution, which focuses on carrying out state-of-the-art research of rare diseases in children, and the collaborations between institutions and other hospitals as a key ingredient to achieve this goal.

High-resolution microscopy techniques for biomedical and clinical applications

Dr. Pablo Loza, Head of the SLN facility at ICFO, gave the first talk to introduce the different microscopy techniques developed by his team, reviewing a wide variety of biomedical and clinical applications. **Dr. Mariona Sunol**, pediatric pathologist at SJD, took over and discussed how Raman spectroscopy is a promising non-invasive tool to analyse in vivo the ocular structures affected by retinoblastomas, the most common malignant ocular tumour in children, and to evaluate the high-risk factors for its metastasis. Recently, this collaborative project between ICFO and SJD received seed financial support from the Fundacio La Nineta dels Ulls, further promoting the research and knowledge of retinoblastoma disease and its treatments.

The next speaker was **Dr. Cecilia Jimenez**, Group Leader of the Applied Research in Neuromuscular Diseases group at IRSJD. She delved deeper into other high-resolution techniques also explored in collaboration with ICFO around neuromuscular diseases and related innovative therapies.

From a more fundamental research perspective, **Prof. at ICFO Michael Krieg** explained the latest advances made in his group Neurophotonics and Mechanical Systems Biology, particularly regarding the Photons as Synaptic Neurotransmitters (PhAST) project. As he stated, their success in optically restoring the mechanical sensitivity in worms further supports the use of light as a new non-invasive, fast and versatile neurotransmitter.

Improving magnetoencephalography for neonates

The next two speakers tackled the current magnetoencephalographic (MEG) methods, their current status and actual problematics, especially for neonates, emphasizing that commercial devices have a huge size, are expensive and are not ergonomically suitable for newborn babies.

Professor Fabrice Wallois, lab Director of the GRAMFC research group and Head of the Pediatric Clinical Neurophysiology Department at the Amiens-Picardie University Hospital, addressed the MAGIC project, which targets pathologies and mechanisms of dysfunction in the brain of children and fetus, according to specific biomarkers, and directly assesses brain activity. **ICREA Prof. at ICFO Morgan Mitchell**, leader of the Atomic Quantum Optics group, complemented the previous talk by sharing the Optically Pumped Magnetometers-Magnetoencephalography initiative, which is working to achieve ultraprecise atomic

magnetometers in a much more manufacturable way without losing their extremely high performance.

Non-invasive tools to monitor the baby's brain

ICREA **Prof. at ICFO Turgut Durduran**, leader of the Medical Optics research group at ICFO, re-opened the event after the mid-day break. He explained the various optical tools that the group has developed over the years for non-invasive hemodynamic monitoring of infants, mainly based on the combination of two methods: near-infrared spectroscopy and diffuse optics. The hybrid resulting technique offers clinicians very useful information regarding the oxygen metabolism of tissues and the blood flow in patients, allowing doctors to make a better assessment of measures such as perfusion and intracranial pressure.

Emphasizing these techniques, **Dr. Joan Sanchez de Toledo,** Chair of Pediatric Cardiology at SJD and researcher at IRSJD, and **Dr. Marta Camprubi**, neonatologist at SJD and researcher at IRSJD, talked about TinyBrains, an ongoing European research project coordinated by ICFO that aims at understanding the mechanisms of brain damage in neonates born with congenital heart defects through neuromonitoring. The first talk described the studies that have been carried out with animal models, while the second focused on the recent clinical studies in newborn babies, explaining how monitoring the brain through these techniques before, during and after surgery can help guide the clinical actions to be taken.

The need for electroencephalography alongside hemodynamic and metabolic monitoring was claimed to be again of huge importance for the protection of neonates and children during seizures. **Dr. Carme Fonts**, Head of the Neurology Service at SJD and researcher at IRSJD, centred her talk around this topic. Finally, **Dr. Maria Antonia Poca**, Clinical Head of Neurosurgery and responsible for the Pediatric Neurosurgery Unit at the Vall Hebron University Hospital, presented the recent photonic tools for monitoring the intracranial pressure in a non-invasive manner, as opposed to current highly invasive methods, such as the one that the SafeICP project is developing.

The annual meeting ended with **Dr. Chiara Santolin**, researcher at IRSJD and the UPF Center for Brain and Cognition who presented her forthcoming studies on the mechanisms of language acquisition using optical imaging.

A fruitful ongoing collaboration

Overall, the 3rd BMPN edition showed the importance of the interconnection between photonics and medical research, highlighting and placing a special interest in how neuromonitoring tools can improve patient management in pediatrics.

Ariadna Martinez, ICFO Light for Health program coordinator, concludes: i¿½It is our honour to see a full room each year for our annual meeting, with a mix of professional profiles that goes from technology developers to clinicians through to innovation managers, both from inside and outside the Network. Multidisciplinary endeavours thrive on collaborative

ambiences like this, and while it is not an easy task (because it demands diverse perspectives, effective communication, and mutual trust) the results are very enrichingi¿?

A moment during the BMPN meeting at the Sant Joan de Deu Hospital

ICREA Professor at ICFO Turgut Durduran gives a talk on the new optical methods for neuro-monitoring that the Medical Optics group is developing

Fundacio La Nineta dels Ulls provides seed funding for study of retinoblastomas

Video summary of meeting