



Département de psychiatrie
Centre de neurosciences psychiatriques
Site de Cery
CH-1008 Prilly - Lausanne

Centre de Neurosciences Psychiatriques

CNP SEMINAR

ANNOUNCEMENT

Friday, April 22, 2016, 11 a.m.

“The developing brain and its vulnerability: Structural basis of psychiatric disorders”

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In order to understand how the brain grows to master complex cognitive functions is a fascinating task of developmental neuroscience. Every step in brain development contains major micro- and macro- structural changes that lead to functional competence from the fetus to the newborn to the child and into adulthood. Non-invasive neuroimaging has allowed researchers in recent years to start to assess these important structural changes during brain development. The three major structural characteristics of the developing human brain are dynamic changes in cortical thickness, the cortical folds with the complex surface structure tightly linked to functional specificity and the underlying connectivity that provides the basis for functional networks. These three major characteristics of the human brain have an intertwined time course of development in the later fetal and early neonatal life and any major environmental change such as prematurity or intrauterine growth restriction can influence these processes considerably and alteration of these processes most likely are at the origin of developmental and psychiatric disorders in childhood and adolescence and beyond.

Survival of children born prematurely or with very low birth weight has increased dramatically in the last decades, but the long term developmental outcome remains a concern {Schlapbach, 2012 2522 /id}. The most common cerebral neuro-pathology observed in case of premature birth is a diffuse white matter abnormality. However, many of the children born prematurely present deficits in their cognitive capacities, in particular involving executive domains (2). The origins of these disabilities are largely unknown but are likely to involve an overriding central



nervous system deficit. In vivo biomarkers of such central nervous system alterations are needed to better target interventions to prevent complex cognitive and psychiatric disorders in preterm and low-birthweight infants.

Understanding rate and variability of cortical development with changes in surface, gyrification and thickness {Dubois, 2008 1680 /id} as well as connectivity in normal brain development {Dubois, 2013 2470 /id}{Kunz, 2014 2535 /id}, and detect differences from typical development offers insight into the developmental origin of childhood and adult brain disorders associated with prematurity and IUGR. To understand the neurostructural origin of these disabilities and to investigate the effect of EP and IUGR in newborns and pre-school children aged 6 years old new biomarkers are presented using non-invasive imaging modalities such as conventional magnetic resonance imaging, diffusion tensor imaging and functional imaging, that have for the first time allowed researchers to describe these macro and microstructural changes and functional maturation in vivo during human brain development {Fischi-Gomez, 2014 2532 /id}

Selected Publications:

1. Dubois J, Hertz-Pannier L, Dehaene-Lambertz G, Cointepas Y, Le Bihan D 2006 Assessment of the early organization and maturation of infants' cerebral white matter fiber bundles: a feasibility study using quantitative diffusion tensor imaging and tractography. *Neuroimage* 30:1121-1132
2. Farooqi A, Hagglof B, Serenius F 2013 Behaviors related To Executive Functions and Learning Skills at 11 years of Age After Extremely preterm Birth: A Swedish National Prospective Follow-Up Study. *Acta Paediatr*
3. Fischi-Gomez E, Vasung L, Meskaldji DE, Lazeyras F, Borradori-Tolsa C, Hagmann P, Barisnikov K, Thiran JP, Huppi PS 2014 Structural Brain Connectivity in School-Age Preterm Infants Provides Evidence for Impaired Networks Relevant for Higher Order Cognitive Skills and Social Cognition. *Cereb Cortex*
4. Guellec I, Lapillonne A, Renolleau S, Charlaluk ML, Roze JC, Marret S, Vieux R, Monique K, Ancel PY 2011 Neurologic outcomes at school age in very preterm infants born with severe or mild growth restriction. *Pediatrics* 127:e883-e891
5. Kunz N, Zhang H, Vasung L, O'Brien KR, Assaf Y, Lazeyras F, Alexander DC, Huppi PS 2014 Assessing white matter microstructure of the newborn with multi-shell diffusion MRI and biophysical compartment models. *Neuroimage* 96:288-299
6. Ment LR, Hirtz D, Huppi PS 2009 Imaging biomarkers of outcome in the developing preterm brain. *Lancet Neurol* 8:1042-1055