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Innovative Research Studies

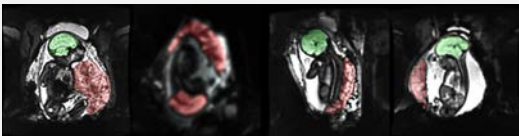
Non-invasive MR imaging of in vivo fetoplacental oxygenation

What is the study about?

The central goal of this study is to assess functional development of the placenta and fetal brain using blood oxygen level dependent (BOLD) functional MRI (fMRI) with maternal hyperoxia. Fetal fMRI data are perturbed by a variety of intractable artifacts, including fetal and maternal movement. To cope with such artifacts, Dr. You has developed a robust toolbox for fetal MRI which is manageable and easily accessible to large MRI databases. The software automates most procedures of fMRI data processing and dramatically speeds up data acquisition through parallel computing. Using a toolbox, we are able to quantify the changes in oxygenation of the placenta and fetal brain as well as hemodynamic function using BOLD fMRI with maternal hyperoxia.

How does BOLD fMRI methods differ from the current clinical standard of care?

The existing tools for BOLD fMRI processing suffer from two major problems: current methods are not well optimized to address fetal motion artifacts and processing speeds are too sluggish such that post-analysis information is not able to be provided to clinicians or Radiologists on time to support clinical decision making. In the intrauterine environment



there are organs moving in unpredictable ways and their shape is dynamically deformed. Our proposed algorithm makes it possible to correct the motion artifact of multiple moving organs such as the placenta and fetal brain.

What are the clinical applications of advanced neuroimaging of fetoplacental circulation and functional brain networks?

The proposed methods can be effectively applied to study fetuses at risk for hypoxic-ischemic injury such as congenital heart disease (CHD) and fetal growth restriction (FGR). Indeed, we have found a significant increase in fetal brain oxygenation during maternal hyperoxia in fetuses with CHD, as reported by the American Heart Association (AHA) in 2015. These findings suggest that in vivo oxygenation of the fetal brain and placenta may be used to obtain early biomarkers of fetal compromise.

How is placental MRI relevant to the work that we do in the Developing Brain Research Program?

Placental MRI is relevant to the Developing Brain Research Program because it is in line with our overarching programmatic goals which includes developing robust in vivo MR imaging methods to diagnose abnormalities in fetoplacental circulation and to identify early biomarkers of impaired placental structure and function in the high-risk pregnancy.



Wonsang You, PhD
Staff Scientist I

Featured Press

[Prematurity Leaves Distinctive Molecular Signature In Infants Cerebellum](#)

[Novel Framework Powered by 3D MRI Accurately Predicts Pregnancy](#)

[Researchers Find Key to Helping Premie Brains Develop](#)

[Prematurity Leaves Distinctive Molecular Signature in Infants' Cerebellum](#)

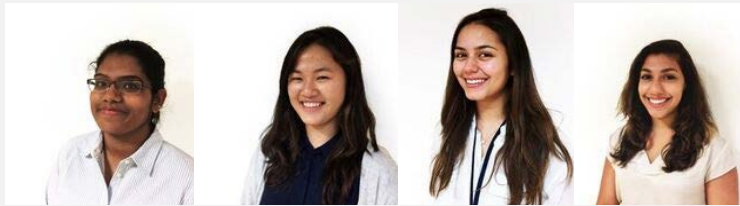
[How Being a Premie Changes Your Brain](#)

[Is Your Placenta Healthy? For the First Time, an MRI Can Find Out](#)

[Machine Learning Predicts Pregnancies with Fetal Growth Restriction](#)

['Glaring Void' in Diagnostics Prompts 3-D MR Solution for Life-Threatening Births](#)

[Prematurity Leaves Distinctive Molecular Signature in Infants' Cerebellum](#)



**We successfully completed our Summer Internship 2017!
Thank you Interns and Mentors for your participation!**



Congratulations!!

Katherine Ottolini, MD for her recent International Symposium on the Fetal Brain Best Abstract Presentation Award, for "Breastmilk Feeds Improve Brain Microstructural Development in Very Preterm Infants."



Research Presentations

International Symposium on the Fetal Brain

Limperopoulos C. Quantitative comparison of brain development in the *in utero* versus *ex utero* fetus. August 2017 (Platform)

Zun Z, Zaharchuk G, Andescavage N, Bauer S, Donofrio MT, Limperopoulos C. Non-invasive placental perfusion imaging in pregnancies complicated by fetal heart disease using arterial spin labeled MRI. August 2017 (Poster)

Wu Y, Donofrio MT, Kapse K, Vezina G, and Limperopoulos C. Maternal stress alters hippocampal development in fetuses with congenital heart disease. August 2017 (Poster)

Andescavage N, Dahdouh S, Jacobs M, Bauer S, Iqbal S, Bulas D, duPlessis A, and Limperopoulos C. In vivo placental microstructure in the growth-restricted fetus using magnetic resonance based shape and textural analysis. August 2017 (Poster)

Ottolini, K. Breastmilk feeds improve brain microstructural development in very preterm infants. August 2017 (Poster)

Human Placenta Project Meeting

Zun Z, Zaharchuk G, Andescavage NN, Donofrio MT, and Limperopoulos C. Non-invasive placental perfusion imaging in pregnancies complicated by fetal heart disease using arterial spin labeled MRI. July 2017 (Poster)

International Conference on Prenatal Diagnosis & Therapy

Andescavage N, Dahdouh S, Jacobs M, Bauer S, Iqbal S, Bulas D, duPlessis A, and Limperopoulos C. Placental textural analysis in the growth-restricted fetus using 3D MRI. July 2017 (Poster)

Published Articles

Andescavage NN, DuPlessis A, Metzler M, Bulas D, Vezina G, Jacobs M, Iqbal SN, Baschat A and Limperopoulos C. In vivo assessment of placental and brain volumes in growth restricted fetuses with and without fetal doppler changes Using Quantitative 3D MRI. *Journal of Perinatology*. 2017 Aug 24.

Chen X, Shan R, Zhao L, Song Q, Zuo C, Zhang X, Wang S, Shi H, Gao F, Qian T, Wang G, Limperopoulos C. Invasive placenta previa: placental bulge with distorted uterine outline and uterine serosal hypervascularity at 1.5 T MRI—useful features for differentiating placenta percreta from placenta accrete. *European Radiology*. 2017 Aug 2.

Dahdouh S, Andescavage N, Yewale S, Yarish A, Lanham D, Bulas D, du Plessis AJ, Limperopoulos C. In vivo placental MRI shape and textural features predict fetal growth restriction and postnatal outcome. *Journal of Magnetic Resonance Imaging*. 2017 Jul 22.

Brossard-Racine M, Murnick J, Bouyssi-Kobar M, Coulombe J, Chang T, Limperopoulos C. Altered cerebellar biochemical profiles in infants born prematurely. *Sci Rep*. 2017 Aug 15.

Tague L, Donofrio M, Fulgium A, McCarter R, Limperopoulos C, Schidlow D. Common findings in late gestation fetal echocardiography. *Journal of Ultrasound in Medicine*. 2017 June 19.

Upcoming Event

Children's National Race for Every Child
Saturday October 21st, 2017