Abstract:
Despite years of research, preterm birth (PTB) is the greatest and costliest burden in perinatology. In large part, this is because of our limited understanding of the pathologic factors that initiate preterm labor and result in preterm birth. Although uterine contractions play a central role in both preterm and term labor, the mechanisms of initiation and propagation resulting in preterm birth remain unknown largely due to a lack of tools to study it until now. As a direct result of the support from the March of Dimes (MOD), we recently developed a new imaging technology, Electromyometrial Imaging (EMMI), to non-invasively characterize the three-dimensional (3D) electrical activation and conduction patterns of uterine contractions. EMMI employs magnetic resonance imaging (MRI) to acquire subject-specific body-uterus geometry, and combines it with up to 256 channels body surface electromyography during contractions to noninvasively image the uterine surface electrical activities across the entire uterus in 3D. EMMI has been thoroughly validated using a translational sheep model. For the first time, we have noninvasively imaged the 3D uterine activation patterns in term and preterm labor patients and observed the wide spectrum of uterine activation patterns.

Bio:
My PhD work focused on developing and applying electrocardiographic imaging (ECGI) to study cardiac arrhythmia and abnormal heart contractions. My work led to inventions and patents in the USA, Europe, Canada, and Japan, and was published in many top journals in the fields of biomedical engineering, biomedical life science, and human physiology. To broaden my technological and biomedical expertise, I switched gears and devoted my postdoc time to neuroscience. With the aim to better understand the pathological mechanisms underlying neurodegeneration diseases, I invented and patented a novel diffusion magnetic resonance imaging (MRI) approach, diffusion basis spectrum imaging (DBSI). In my papers published in Brain, I used DBSI to specifically measure and characterize multiple white matter microstructural changes and study the mechanism of lesion evolution in multiple sclerosis, Alzheimer’s disease (AD) patients and animal models of this disease. In 2015, I was recruited to the Departments of Obstetrics and Gynecology and of Radiology, where I collaborate with obstetricians and radiologists to invent and clinically translate the novel high resolution electromyometrial imaging (EMMI) to study the electrophysiology and microstructure of the uterus. I also successfully translate DBSI to image the placental immune response during normal and abnormal pregnancy.