CEST MRI for assessing molecular abnormalities in aging brain

PI: Prof. Kannie Chan
Co-I: Prof. Youngjin Lee, Prof. Huiyong Yin, Prof. Xiangyu Zhao (SDSC)

Abstract: Enumerating the abnormalities in the brain during aging is paramount to minimize the risks to dementia, stroke, Parkinson's disease, and other neurological disorders. The ultimate goal is to protect the brain from injury that affects mobility and cognitive function. The morphological changes do not develop instantly and sometimes show no any symptomatic signs of the shadowed dysfunction developing in the brain. Increasing evidence shows that morphological dysfunctions are associated with the alteration in metabolic activity and cellularity. For example, aging brains are found with alterations in glucose and lipid metabolism and sometimes protein alterations (protein misfolding) affecting the cellularity of the neurons. Tracking these metabolic changes in the brain locally *via* minimal non-invasiveness is always a great challenge. Though conventional MRI can provide some pathological details, it fails to reveal the molecular changes and its exchange environment. On the contrary, the chemical exchange saturation transfer (CEST) MRI sequence shows promise in detecting multiple molecular events related to metabolism, cellularity and pH-related events. The early defining moment of age-related abnormalities in the brain are related to metabolism, cell integrity, and protein dysfunctions. Therefore, it is critical to detect these abnormalities and take proactive action. This proposal aims to develop a non-invasive sensitive CEST MRI method to monitor brain abnormalities tethered with aging, which enables the identification of risks that could lead to neuronal injury. The study capitalizes on altering molecular events (such as glucose and lipid metabolism) and cellularity in the aging brain non-invasively using CEST MRI, avoiding any exogenous markers/ or chemical agents. The study will provide an overview of neuronal health and any related metabolic dysfunction related to age that can aid in predicting pathological disorders.