Perfusion, or blood flow, is one of the most basic measurements one can make of an organ system. It controls the delivery of oxygen and nutrients as well as the removal of waste products. Measuring baseline perfusion and understanding the mechanisms that control perfusion under different circumstances can yield insight into normal physiology under rest and stress conditions. Disorders of perfusion, particularly those related to blood flow decreases, include the most common and devastating diseases, such as ischemic stroke and cardiac disease. Other diseases can be detected or surmised based on changes to perfusion due to the frequently tight coupling between blood flow and metabolism include seizures, tumors, and neurodegeneration.

Multiple different approaches to measuring perfusion have been discovered and applied using MRI, including dynamic susceptibility contrast (DSC) and arterial spin labeling (ASL). While these MR techniques have found their main applications in the brain, clinical applications are emerging in other organs, often using other biomarkers related to perfusion, such as dynamic contrast enhanced (DCE) imaging. In this talk, I will briefly discuss these MR techniques and then highlight the most common clinical applications of perfusion imaging, focusing on the brain but also discussing briefly other organ systems. Additionally, I will include some unexpected findings that may be seen on perfusion imaging that can improve clinical diagnosis. In summary, this presentation will outline the most common ways that MR perfusion imaging is used clinically, and the challenges that must be overcome to achieve more widespread applicability, and ultimately, to more broadly use these techniques to accurately diagnosis and alleviate human disease.