Visualizing the internal human body in motion

Our body is an impressive and refined biomechanical system that is engineered for motion. While the musculoskeletal system provides strength, endurance, and fine motor control; biomechanics are also crucial in the function of critical physiological systems such as the cardiovascular, respiratory, and gastrointestinal systems. These systems depend on biomechanical forces to facilitate processes like digestion, blood circulation, and gas exchange, playing a crucial role in maintaining metabolism and local physiology. To fully comprehend how these systems operate, it is essential to study them during natural, weight-bearing activities and physical exercise using non-invasive imaging techniques. Our goal is to develop a biomechanical imaging infrastructure that allows for dynamic imaging under active, weight-bearing conditions. In this project, we aim to create a unique MRI infrastructure that will allow researchers to study the biomechanics of the human body in those types of conditions. This infrastructure will overcome major limitations of conventional MRI scanners, which limit the body's position to a static, horizontal position that does not accurately reflect body behavior during everyday activities or exercise.

This project will focus on three critical areas of fundamental research where biomechanics and cellular metabolism are key: cardiovascular health, musculoskeletal biomechanics, and metabolism and digestion. By realizing this novel imaging infrastructure, we aim to revolutionize understanding of how biomechanical forces shape anatomy and the physiology of key body systems. This fundamental knowledge will lead to advances in personalized medicine and treatments for diseases such as cardiovascular disorders, degenerative joint diseases, rehabilitation of injuries and metabolic conditions.