As you read this abstract, please take a second to ponder how you are able to sit without having your spine collapse under the load of your upper body. If you are lucky, you have spinal stability and are free of discomfort. Unfortunately, for many, a form of collapse or mechanical failure is present. Understanding the mechanisms that contribute to spinal stability, or lack thereof, is the global theme of the Musculoskeletal Biomechanics Research Lab. Spinal disorders and associated back pain currently represent an epidemic hindering productivity and creating a massive economic burden to developed nations such as Canada. The presentation of a spinal disorder, mechanically, represents a flawed stability mechanism. The Musculoskeletal Biomechanics Research Lab leverage cross-disciplinary platforms and collaborations while studying spine biomechanics to generate and validate novel interpretations of spine stability and, consequently, explore potential mechanisms of spinal instability and subsequent disorders. The research program leverages prior expertise in spine biomechanics, high-performance computing, patient based physiological 3D models, custom programed finite element modeling, ex vivo bench testing and in vivo analyses. Furthermore, the research program employed in the lab, train students in these areas while feeding the fast-growing demand of biomedical engineers in the medical device market. Moreover, the lab strives to continue to have an impact by conceiving new diagnostic tools, treatment methods and medical devices with the shared goal of improving spinal stability.