

## ***A Pilot Project: Mechanical Damping and the Spine***

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The long-term objective of this pilot project (Mechanical Damping and Spine) is to develop a strategy for reducing back pain through investigation of the mechanism of mechanical damping in spine and gene expression induced by loads. Back pain is a common symptom encountered by many workers engaged in a variety of occupations. A group of researchers at the University of Cincinnati, led by Dr. Bhattacharya, made an intriguing observation about superior mechanical damping in spine in healthy individuals, which allowed us to raise a set of questions: Is an intervertebral disk, a vertebral body, or a surrounding tissue a major contributor to mechanical damping in the spine? Does cyclic loading to the spine enhance mechanical damping? If yes, what genes are activated in the disk, body, and surrounding muscles and ligaments? A specific goal of this project is to answer those questions using mouse spine as a model system. Our working hypothesis is: cyclic loading activates genes that alter viscoelastic characteristics in the disk and body, and enhances mechanical damping in the disk and connective tissues as well as mechanical stiffness in the body. To test the hypothesis, we are conducting the following specific aims:

Aim 1: Damping analysis of the disk and body as well as surrounding tissues in response to impulsive loads

Aim 2: Gene expression analysis of the disk, body, and surrounding tissues in response to cyclic loads

Loads are applied with an electro-force loading device, and a finite element analysis is conducted for evaluating experimental data for damping and stiffness. Gene expression is analyzed using quantitative real-time PCR. We expect that impulsive loads will be damped mostly through the intervertebral disk but the contribution of the vertebral body is not negligible. We also expect that moderate loads through cyclic loading not only elevate bone mineral density in the vertebral body but also increase mechanical damping in the intervertebral disk and surrounding tissues. The proposed study should contribute to our basic understanding of the mechanism of mechanical damping in the spine and the role of loading for regulating back pain.

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