COUNTERING SPINAL DISC DEGENERATION

The pain caused by spinal disc degeneration affects millions of people worldwide and, too often, causes disability and opioid addiction. Current therapies for degenerative disc disease address only symptomatic relief. However, it may be possible to address the underlying problem by using endogenous stem cells to rebuild diseased or degenerated tissues.

Longtime research collaborators **Makarand Risbud, PhD**, James J. Maguire Professor of Orthopaedic Surgery, and **Irving Shapiro, PhD**, Gertrude and Anthony DePalma Professor of Orthopaedic Surgery, are working to understand the cellular mechanisms underlying disc degeneration, identify conditions that enhance disc cell survival and create tissue-engineering methods to regenerate healthy discs.

They are characterizing disc progenitor cells from both normal and diseased discs; then defining environmental conditions that enhance progenitor cell differentiation into cells that comprise the disc's inner tissue, the nucleus pulposus. Drs. Risbud and Shapiro hypothesized that adult mesenchymal stem cells (MSC) transplanted into the disc will assume nucleus pulposus-like characteristics and help restore degenerated disc tissue—and, thus far, they have shown that MSCs differentiate into nucleus pulposus-like cells under conditions similar to those existing in the disc in vivo.

On a parallel track, Drs. Risbud and Shapiro are characterizing a mouse model of spontaneous, early onset disc degeneration. (The lack of appropriate small-animal models has impeded research on the mechanisms underlying and driving the early onset process.) These models will also be important for testing the efficacy of the MSC-derived tissues. To date, the researchers have demonstrated that their mouse model recapitulates many features of human disc degeneration, including compromised cell survival and the changes to the cellular environment that lead to compromised tissue function. In addition, compared to control animals, the mouse model discs were stiffer, had decreased height and poor vertebral bone quality. ■