Low back pain is the leading cause of disability and is closely linked to disc degeneration. Intradiscal biologic therapy is a promising strategy for managing disc degeneration. However, an unresolved issue is whether a degenerated disc has adequate nutrient supply to support the higher metabolic demands required by these therapies. This is because nutrients and metabolites entering and exiting the nucleus pulposus must pass through the cartilage endplate (CEP), and it’s unclear if CEP permeability is a limiting factor for nutrient transport. To address this issue, we used a novel in vitro diffusion chamber that separates disc cells from their nutrients by human cadaveric CEP samples. Results to date demonstrate that nutrient diffusion across the CEP is insufficient to meet the metabolic demands of disc cells when solute diffusivity in the CEP is less than 60 µm²/s. Detailed spatial analysis of matrix biochemical composition in the CEP revealed that CEPs with low solute diffusivity have higher collagen content, higher mineral/matrix ratios, and lower collagen maturity. Ongoing studies are aimed at: 1) characterizing the effects of fluctuations in CEP permeability on anabolic and catabolic gene expression; and 2) optimizing in vivo imaging protocols for non-invasively assessing CEP biochemical composition. This research will exert a broad impact by providing validated tools and a mechanistic framework to determine the role of CEP permeability in disc degeneration severity and by establishing the first non-invasive selection criteria to identify discs that can support the higher nutrient demands required by biologic therapies.