Nuciferine-Loaded Lipid Nanoparticle Microneedles Alleviate Intervertebral Disc Degeneration by Restoring Nucleus Pulposus Cell Homeostasis

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Running title: Nuciferine Microneedle System for Intervertebral Disc Degeneration

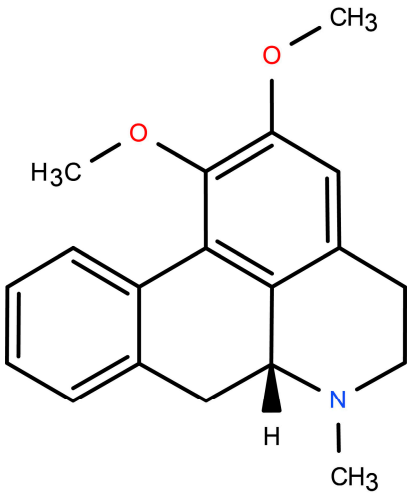


Figure S1. Chemical molecular structure of nuciferine.

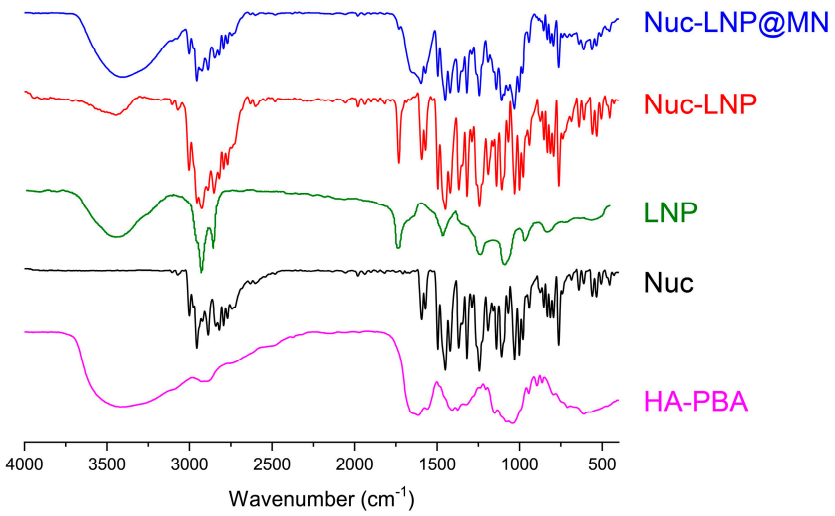


Figure S2. Fourier-transform infrared (FTIR) spectra of HA-PBA, free Nuc, blank LNP, Nuc-LNP and Nuc-LNP@MN

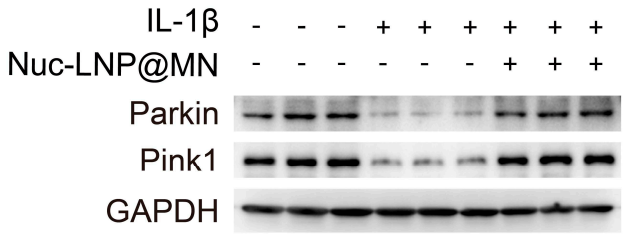


Figure S3. Nuc-LNP@MN activates PINK1/Parkin-mediated mitophagy in IL-1β-treated nucleus pulposus cells.

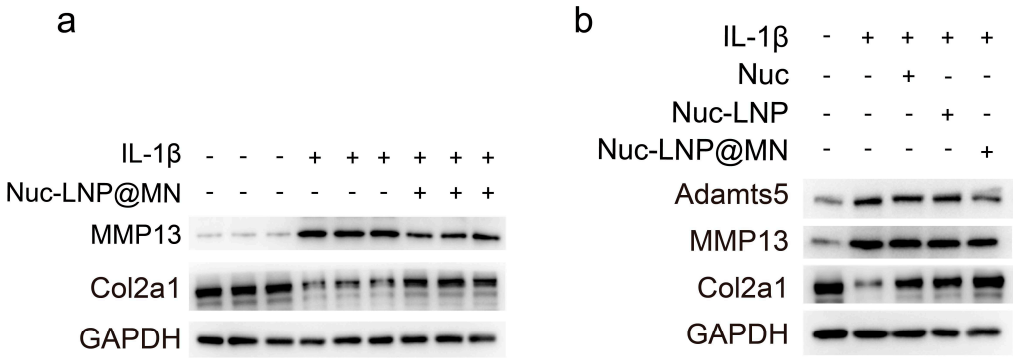


Figure S4. Nuc-LNP@MN alleviates IL-1β-triggered extracellular matrix degradation in NPCs. (a) MMP13 and Col2a1 in control, IL-1β, and IL-1β + Nuc-LNP@MN groups. (b) Adamts5, MMP13 and Col2a1 expression among free Nuc, blank Nuc-LNP and Nuc-LNP@MN treatment groups upon IL-1β stimulation.

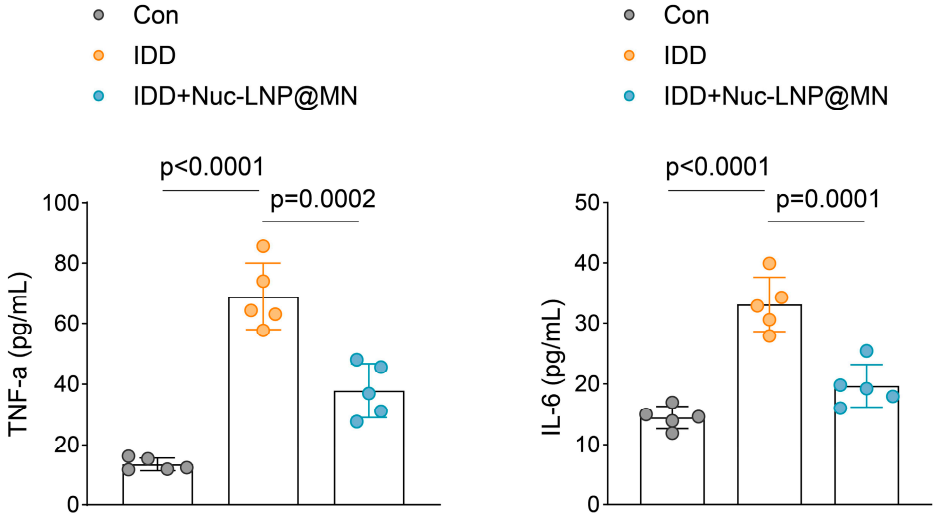


Figure S5. ELISA results showing tissue concentrations of TNF-α and IL-6 across Con, IDD, and IDD + Nuc-LNP@MN groups. Data are presented as individual points with mean ± SD. P values were obtained from one-way ANOVA. P<0.05 indicated

statistically significance (n=5).